An Introduction to Surplus

By

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Introduction

A great number of elements have come together to cause this book to be written. Among these are the increase in the number of amateurs and other interested parties such as short wave listeners, the increase in the cost of new equipment, the resultant growth in the need for alternatives to this more expensive equipment, and the decline in the number of current articles on surplus conversion.

This volume is not a conversion manual. It is, instead, as the title suggests, an introduction to the surplus arena and contains basic background information helpful to those new to the field. Also included are some basic power supplies to help get the equipment going plus some lists of conversions which have been printed in the past.

Quite a few people have helped and are helping me with this project, and I would like to acknowledge them at this time. These are George and Phil Sellati of Fair Radio for their interest, cooperation, and tolerance of yards long letters and "unique" requests, Al Smochko for on-the-air signal checks, the 09/69 Nut Net (The best bunch of hams I've ever had the pleasure of knowing) for their assistance and encouragement, and my wife for her tolerance of mountains of equipment, the odor of burning solder (and the occasional minor burn-out) and long hours of "just one more idea". This book is from all of us to all of you. Enjoy.

Chapter 1

What Is Surplus and Why Use It?

I have, for several years, been using surplus equipment for my ham station. As a general rule, both the transmitter and the receiver are military equipment, although I do, on occasion, sneak a civilian receiver in as well. My antennas are invariably home-made and are usually short, loaded verticals. I also typically run at lower power levels -ie, in the 50 to 75 watt input range.

While this book was being written, I was using a Bendix TA-12 transmitter on 40 meters. This is an old aircraft transmitter which came out during World War II and covered (in this unit's case) 3 to 12 mHz in three bands plus an LF band. Out of respect for the unit's age, plus a lack of a more potent power supply, I ran this unit at 25 watts output on cw. My antenna at the time was a 23 foot top-loaded vertical with no radials. With this peanut whistle, I managed to work over a dozen new countries, including New Zealand. During this time, I did not get one bad signal report, and generally got quite favorable ones.

The performance of the old Bendix, and other sets I've used, pretty much sum up why I use surplus. That is, the performance is outstanding for the price and, in some cases, is better than civilian equipment. There are a lot of reasons to use the older equipment, and these will be covered later in the chapter. However, first, let's look at what surplus is in the first place.

Surplus is anything that exists in excess to current and/or projected needs. For example, if one buys a new car without first disposing of the old one, the latter is, under most conditions, surplus. Another example is if one buys five couplings for in-house plumbing with an immediate need for two and a projected need for two more. The last one is then surplus. Surplus is, then, a common, everyday phenomenon.

The government also has surplus, however the range is wider and the quantities higher than elsewhere. The range goes from buttons to bombers and the quantities from tens of thousands of an item to only one or two. The methods by which surplus is accumulated are various as are those by which it is disposed of. For our purposes, however, let's just look at military radios and see what happens.

Radio equipment becomes surplus for a variety of reasons, most of which boil down to two basic areas - technological advances and

changing military requirements. While the degree to which each is involved varies, each of these two is involved to some degree in nearly every case. The various reasons may also be broken down into two separate catagories - evolutionary changes and generation changes.

At the beginning of World War II, virtually all military communications were AM or CW in the 2-20 mHz range. About the time of the U.S. entry into the war, aircraft operating in the European theater began using AM equipment in the 100-156 mHz range. This was used for air to air and air to ground tactical (or "Command") communications, in line with existing British facilities. Somewhat later, ground tactical communications (particularly among armored vehicles) began to operate wide-band FM in the 20-39 mHz range. Further, radio-teletype began to show up in the longer range, strategic communications. The overall effect was a reduction in the strain and confusion on the available frequencies.

After the war, civilian aircraft began to use the 100-156 mHz range and military command communications moved up to the 225-400 mHz range, still operating AM. The VHF equipment was retained, however, to maintain compatability with civilian facilities. Both are still carried today, as well as HF radios on some aircraft requiring them for air control and/or long range (liason) communications.

Ground tactical communications also continued to change. The spectrum used grew to 20-55 mHz (still FM) by the Korean War, and has since grown to 30-76 mHz. Utilization has grown to include virtually all tactical and support units. HF is still used, however to a lesser degree than before and with SSB added to the operating modes.

Strategic communication now covers the range to 30 mHz and includes radio teletype, SSB, ISB, etc which have all but replaced AM and CW as the primary operating modes. Output power levels have increased by a factor of ten with some fixed base sets going to several kilowatts output.

These evolutionary changes have been accomplished with generation changes as well. For example, through the 1950s and the early 1960s, the AN/PRC-8, -9, and -10 were the standard packsets, covering (together) the 20-55 mHz range. These tube-type units were replaced by the AN/PRC-25, a hybrid set covering the 30-76 mHz band. This set was, in turn, replaced by the AN/PRC-77 which covers the same band but is all semiconductor. Clip-on pocket radios and helmet sets have replaced walkie- talkies as well.

Standardization has also played a part in creating surplus. As noted in the previous paragraph, the AN/PRC-25 replaced three different sets with one. Similarly, sets are being designed to fit standardized mounts to facilitate replacement and upgrading.

Some sets become surplus by one of two other methods, these

changing military requirements. While the degree to which each is involved varies, each of these two is involved to some degree in nearly every case. The various reasons may also be broken down into two separate categories - evolutionary changes and generation changes.

At the beginning of World War II, virtually all military communications were AM or CW in the 2-20 MHz range. About the time of the U.S. entry into the war, aircraft operating in the European theater began using AM equipment in the 100-150 MHz range. This was used for air to air and air to ground tactical (or "Command") communications, in line with existing British facilities. Somewhat later, ground tactical communications (particularly among armored vehicles) began to operate wide-band FM in the 20-30 MHz range. Further, radio-teletype began to show up in the longer range, strategic communications. The overall effect was a reduction in the strain and confusion on the available frequencies.

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being "red-tagging" and "planned replacement".

There are three colors of tags used to indicate the condition of equipment. These are green for operational units, yellow for repairable units and red for unrepairable ones. ("Unrepairable" is defined within economic and/or time and facilities constraints.) Equipment that has been red tagged is gathered into lots and sold for its parts or scrap value.

Planned replacement is based on "frequency of repair" statistics for a particular type of set. If, for example, a set shows a marked increase in failures after 50,000 operating hours, then it will be replaced when it has run for that amount of time. The unit may be operating perfectly when it's taken out of service, however the need for continued reliability justifies this replacement. These units are also gathered into lots and sold off, although in this case, all three color tags may be seen on the sets.

Disposal of equipment is, with a few exceptions, by bid sale. When equipment is no longer needed by the government, it is gathered into lots at any of several sites and put up for sale. Interested parties submit bids on the lots, and the high bidder on each lot gets it. If the bids are all below what the government considers a reasonable amount, they may all be refused and the lot withdrawn from the sale. It may then either be put back up for sale later or broken up and the units in it distributed to other lots. There is actually more to it than this, but for a brief outline, it is just about that simple.

Some equipment, notably cryptography units and other "sensitive" gear, rarely if ever is sold but rather is destroyed. Other equipment is routed through HEW for distribution to schools and other institutions, some is sold for export, and a few pieces wind up at flea-market type sales at selected sites. For the most part, however, it does wind up in public hands.

The amount of equipment that has become surplus has diminished over the past several years for two basic reasons. First, the vast number of units built for World War II have finally been chewed away. Where there had been tens of thousands of units on the market after the war, there are now tens or hundreds -if they're available at all. Second, for economic reasons (and in some cases, security reasons,) the government is tending to hang on to units longer. As a result, change-overs are less frequent, which in turn reduces the overall supply.

Some material is showing up from Canada. Most of this is of Canadian manufacture, although some is U.S. built equipment exported to Canada. The units are largely of U.S. design, although some Canadian and British designed units are also showing up. This alternate source of supply has turned up some sets that have all but disappeared from U.S. stocks, plus some variations on currently available material. The quality is the same as the domestic

equipment and that, as we'll see later, is high.

The equipment now available ranges from World War II vintage to the 1970s with a median around the late 1950s. Most of it is all tube with some hybrid units like the AN/PRC-25 and AN/TRC-77 and a few all semiconductor units like the AN/PRC-77. The latter two groups are showing up more frequently as later equipment is released. While the design age may be old, the units themselves may have only been taken out of service recently. For example, some of the W.W. II Command sets were overhauled and put back in service as recently as 1963. Also, the R-648/ARR-41, a late 1950s design, was still in service as late as 1976. This 20 year life span, which in electronics is not bad at all, is a fair indicator of how good the sets really are.

The operating environment that military equipment is designed for is, to put it mildly, unkind. It includes extremes in environmental conditions (temperature, humidity, etc,) high g-loads, vibration and mechanical shock that would ruin other sets. It must not only survive these conditions, but it must work "first time, every time" while doing so. To handle this, the sets must be ruggedly built from quality designs and components. however portable and vehicle or aircraft mounted units may neither be heavily built nor may they be overly large due to space and weight bearing limitations. The end result of all of this is high-quality, precise and rugged units that are as compact and light-weight as possible. Just to add to the specification confusion, the sets have to be able to be repaired by military personnel as quickly as possible which implies no unnecessary complexity. (Plug-in modules that may be sent back for maintenance or discarded is one way around that which is becoming popular with manufacturers.) Finally, not only do the sets have to be built by more than one vendor, but the components do as well, which means standard components except in a few rare cases. This is called "Second Sourcing" and is an insurance policy of sorts to guarantee the equipment will be available.

Rather amazingly, companies do wind their way through these sometimes conflicting requirements and have their designs approved. The quality to do this, however, is expensive. Even though the government usually awards contracts to the lowest bidders, the price tag per unit is still high. The vast majority of the designs bought are specifically for a particular bid request, hence the design and tooling costs are part of the price tag. (This is adjusted somewhat on reorders and second source orders.) Sometimes a "stinker" will get through, but usually the government gets what they pay for.

Sometimes a vendor will already have a unit in production that will meet the bid specifications as is or with minimal alterations. Among others, the Hammerlund Super-Pro's, the Collins 51J-series and a number of Technical Materiel Corporation units fall into this group. (As a note, the BC-610 started its life as a Hallicrafters amateur transmitter.) This is advantageous to both the government and the vendor since the design and tooling costs are already

covered plus the lead time is reduced. (Lead time is the lapse from the time an order is placed to that of the first deliveries.) Further, spare parts are already available which reduces one problem found with new designs.

Second source equipment is functionally the same as that produced by the original vendor. There are differences between the two (or more,) however, depending on manufacturing techniques and phiosophies. This is exemplified by the RT-427/ARC-39. Aircraft Radio Corporation was the original vendor for this set. They built them using ceramic coil forms and tie strips plus used sealed IF transformers. Sunair was a second source for these receiver-transmitters and used fiberglass coil forms and terminal strips plus used IF transformers that could be opened. Both units met the original specifications, however the A.R.C. units used the more expensive components. This is typically but not universally true. Stromberg-Carlson was a second source for the A.R.C.-designed AN/ARC-5 (etc) series of Command sets and the later Type 12 units. In this case, the second source units are equal to the originals in quality and components used, and some feel they are better. Except for obvious differences and/or experience, there is no reliable way of telling if a second source unit will be equal to one built by the original vendor or not.

On occasion, a vendor will have a design approved but not be the original builder. Some years ago, a well known test equipment manufacturer had a design approved only to have the contract for the first lot go to another well known manufacturer. The result was a well designed and built piece of equipment...plus a lot of hard feelings. This has happened before and will probably continue, which only serves to confuse things greatly.

One answer to the question "Why use surplus?" is presented fairly well in the preceding paragraphs. It is quality equipment available for pennies on the dollar of original purchase price. Often the cost is less than that of a civilian unit with comparable characteristics. For the beginner, this is a good and inexpensive way to acquire reliable and useful gear. Further, the nature of the equipment is such that replacement is often not necessary when the bands are altered as they were with the recent WARC.

There are several units that require no conversion to operate. These are mostly receivers although there are some transmitters, FSK converters, antenna couplers, etc that are also ready to run. (Common test units - as well as some uncommon units - will, for the most part, work as is and present a very good value.) These units are generally more expensive than those requiring conversion, however this is often an acceptable trade-off. Incidently, a good number of these units are commercial pieces that were pressed into military service.

The greater number of units do require some work to get them running. This ranges from simply adding a power supply to a nearly total overhaul. Happily, a large number of the units fall toward

the former. These are, as a general rule, less expensive than the ready to run sets, with availability and desireability being factors. Often the cost of conversion is low enough that it is less expensive than using commercial or ready to go surplus equipment of comparable characteristics.

The conversion process is a learning experience. It provides exposure not only to several different design approaches, but also to modifications and improvements on them. This study is goal oriented. That is, it is directed toward making an operating unit more useful. The lessons learned this way are applicable to other equipment which, in turn, provides further growth. Additionally, the process helps relate symbols on a schematic to real devices in their many forms and to many methods of construction. Finally, it gives practice in wiring techniques which is always valuable and helps one gain the confidence to get into a unit to modify or repair it.

Even though the majority of available units are tube type, the same basic procedures are followed with semiconductors. An oscillator is still an oscillator, whether it has a tube, a bipolar or field effect transistor or an integrated circuit. Altering the resonant circuit will alter its characteristics according to the same rules. The same holds true, within device limitations, with practically any other commonly found circuit. This helps if one is upgrading a unit with different technologies or is familiar with one technology but not another.

There is one other benefit to doing conversions, only this one is more personal rather than technical. This is the sense of accomplishment in getting something to work the way you want it to. There is a definate sense of pride in saying "I did it", especially after getting as favorable signal report or making a difficult contact with a piece of equipment that one has converted. As part of this, there is also the desire to do better next time. This isn't a conscious effort, but rather due to natural competitiveness, only in this case it is with one's self. Each conversion is done more carefully with an eye toward better performance and/or appearance. And each time, there is just that much more pride in a job well done.

In all fairness, some of the reasons why people shy away from conversions should be mentioned. While there are quite a few, most fall into one of four catagories - power, size and/or weight, unusual or unreliable circuits, and finish. Let's look at them.

As mentioned before, often a unit lacks a convenient power supply to operate. Usually, surplus equipment operates from 24 volts dc with some sort of internal or external high voltage supply. As a result, what may be an otherwise fine set is often bypassed due to its lack of a 115 vac supply. While running gear from 24 volts dc is possible and is done, the older gear uses dynamotors which are noisy. Dynamotor whine (and, for some sets, vibrator hash) is not pleasant to listen to and becomes nerve

wracking after a while. They also eat large quantities of current and, while good for a temporary solution, are not great for long term use.

As we'll see in a couple of chapters, power supplies are easy to build. What makes it better is that a number of different types of transmitters and receivers operate from the same basic supplies. Of the remaining sets, most may be altered to operate from the basic supplies. The rest require special supplies which are no less easily produced however are limited in their applicability. Power supplies are also available already built and may be used directly or with minimal alteration with a number of sets. Power is, therefore, no real problem.

Military equipment is no larger or heavier than it has to be to complete its mission. There have been some large and or heavy sets, notably the old tank and Navy ship-board sets. These were designed to withstand the firing shock from the guns carried. Later design techniques have cut the size and weight down. Military sets are still solidly built and, on a pound per watt basis, often outweigh civilian sets of similar characteristics. It should be noted that military sets are very conservatively rated, which causes the pound per watt comparison to be even worse. Aircraft radios have to be as compact and light as possible. Every ounce of excess in aircraft equipment is an ounce off of the payload capabilities of the airplane. Space is also very limited and often dictates what may or may not be carried. These factors all combine to make equipment that is smaller, lighter and at least as precise as the ground-mounted equipment. These latter sets, while not as restricted as the aircraft radios, still have limitations on the amount of power and space available to them. In many cases, however, they must be more ruggedly constructed than the aircraft sets, which serves to increase their weight.

As discussed before, the circuits used by the military can't be unusual or unreliable. Every once in a while, an "oddball" does sneak through but these are few and far between. While all the circuits aren't the "handbook" variety, a little quick analysis will show that they're not all that far off either. More often a set will go toward being complex, especially in the more recent sets. (The AN/ARC-58 is a good example of this.) However these designs are nothing more than a collection of basic circuits blended together.

The belief that military designs are unreliable comes from the differing needs not only between military and amateur services, but also between amateurs. An exceptionally good example of this is found in the old Command sets. (These are the ATA/ARA, SCR-274-N and AN/ARC-5 series of transmitters and receivers.) These units were simultaneously the most popular and the most maligned radios to come up as surplus. The receivers were broad, and the transmitters would chirp, click, drift and/or cause TVI if given the chance. They were also responsible for getting a large number of amateurs (the author included) on the air due to their rugged dependability

and simplicity. The receivers, while broad, could be converted to other bands and narrower bandwidths without a whole lot of trouble. The transmitters cleaned up in a weekend with little more than some bypass capacitors, a voltage regulator and some window screen. Even after 40 years, these units are still useful and are still heard on the air. The idea that they're not reliable comes from people not using common sense with them. This is true, not only of the Command sets, but of nearly all military equipment.

Probably the worst excuse for not converting military equipment is a dislike for black wrinkle, olive drab or equipment grey. The finish on a radio has nothing to do with the way it works, but rather whether or not one approves of the appearance. This is one place where one may be creative - making it look the way the builder wants it to rather than as the factory produced it. Paint and contact paper do wonders for a unit's appearance. There is nothing wrong with putting together an outer "skin" of, for example, hand rubbed walnut and ebony. This would disguise a military set rather beautifully. Let your imagination roam on refinishing and do it as you want.

One other problem is a lack of conversion information. Admittedly, not much has been printed in the past five to ten years and there is only one book in print on the subject. The lists in chapter 7 should help with most cases and many of the conversions may be adapted to other sets not covered by them. The magazines listed often may be found at hamfests very cheaply. Alternatively, the publishers sometimes have them available as back issues and they may be found in the larger libraries. Lastly, a lot of old-timers keep their back issues and 99 out of 100 times are happy to let some one dig out an issue or two to find old conversions. (The hundredth one probably lent out books only to have them disappear so is guarding what's left very closely.) These self-same old-timers are also usually gold mines of information and often are willing to help get an old unit running. It never hurts to ask.

Given the benefits to converting, there is little, if any, reason not to. Let's go on and look at some fundamentals.

Chapter 2

Some General Hints

As in nearly everything else, there are some basic "rules" to converting surplus. These are actually guidelines to get one from point A (having an unconverted set and a specific need) to point B (having a unit satisfying the need.) They are really little more than common sense, but for a beginner they may not be so obvious.

The first rule is probably the easiest to follow. It is to get a schematic of the unit to be converted. While it is better to have a manual, a schematic that shows parts identification and values is very important. It is a "map" of the unit without which one can't work effectively. It also allows one to learn how the set operated originally so the conversion makes more sense.

Manuals are better to have, however are less often available. They not only have schematics, but also wiring diagrams, voltage and resistance charts and a discussion on how the set operates, all of which are very helpful. (Note that these are the service or maintenance manuals. Operating instruction manuals usually do not have this information. In some cases these are combined into one book. In others, they are two or more separate volumes.) They are a worthwhile investment, especially when the unit quits working. When manuals aren't available, it's wise to make up at least partial wiring diagrams, voltage and resistance charts, etc once the set is working properly. This will help later on in case of failure as a substitute for the originals.

Making a copy or two of the schematic and any other information that may be altered is recommended prior to conversion. The original should then be put away and the copy marked with the changes. A variation is to have a "doodle" copy where changes are marked in pencil so, if they're removed or don't work, they may be erased. (This is also a working copy subject to solder burns, coffee stains, etc.) The second copy has the changes marked in ink once they're more or less permanent. This one is put with the original to provide a running record of changes done to the set. Keeping a log of modifications is strongly recommended and this is one way of doing so.

When you get a piece of equipment, the very first thing that should be done is to inspect it thoroughly. This accomplishes three things. First, it is a "familiarization tour" which allows one to get acquainted with where the various components are prior to

conversion. This helps move things along since time won't be taken later hunting for the parts affected. Second, it locates any possible problems such as burned resistors, leaking capacitors, broken wiring or components, etc which indicate that service will be necessary before conversion. Third, it lets one know what kind of service the set has received. If it's dirty or there are sloppy solder joints or other inconsistancies, the responsible technician probably just kept it going at the minimum performance requirements. It would be wise, in this case, to check the unit thoroughly for problems. If, on the other hand, it's neat and clean with any repairs looking like the original factory work, then it probably received good to excellent maintenance and, except possibly for component aging, is in fairly good shape.

While the set is open, it's usually a good idea to clean it as needed. This improves the appearance and gets any crud out that may cause later problems. It also offers another opportunity to look the set over again and perhaps spot things missed the first time.

On the next point, there are two general schools of thought, and that point is testing the unit. One group says that, no matter what, get the unit working before doing any converting. The other says just the opposite - do all the conversions first then make it work all at once. Both have their merits, however a third route somewhere in between has proven to be the most practical for the author.

The middle road to the "test first or last" decision is to test as soon as it's practical. If power is available and any special conditions, such as needed crystals or control units, are met then testing after the initial inspection is fine. If, on the other hand, some work is needed (for example, a tuning or control arrangement installed) then the testing can wait until it's feasible. Each case must be taken individually to determine what to do with the set.

It is, by the way, not a bad idea to test in stages. If several things are to be done to a unit, then it may be checked out as soon as practical with added checks after each set of steps in the conversion. This provides a running check so that if something goes awry, then it's easier to locate the problem.

One set of tests that may be done before starting a conversion is to check all the tubes and go through the set with an ohmmeter. The latter will help locate any bad resistors, capacitors and inductors. This is made much easier if the voltage and resistance charts are available. If they're not, then it may be necessary to unsolder one end of some components to check them. If the RF and IF inductors may be reached with a grid dip meter (and if one is available) they may be checked for resonance, shorts, etc. Electrolytic capacitors and anything that looks like it has gotten unduly hot should be suspected if not replaced outright. If these components haven't failed already, then they may be close to doing so. These simple checks can save an awful lot of time and

frustration later on.

When you are ready to begin a conversion, read over it, locating the areas and components to be altered in the unit. Determine how you want to accomplish what is to be done and if you have the parts to do it. It is no less than frustrating to be well into a conversion only to discover that one part isn't on hand. (This, according to Murphy's Law, will happen approximately ten minutes after all the parts houses have closed for a long weekend.) As often as not, the exact procedure suggested by the author won't be able to be used. This may be due to model differences, component differences (for example, axial versus radial lead capacitors,) or any of a number of other factors. In this case, the "dry run" will allow an alternate method to be developed according to local inventory, talent, and/or tastes.

At this point, you are ready to start the conversion. As you go through it, check off each step as it's done. This saves debugging time later on from a skipped or mis-read instruction. If it's possible to break the instructions into logical groups, then do so. Once a group is done, then go back and make sure all is as it should be. After the conversion is complete, go back over the whole thing and check it one more time. While it may seem redundant, this takes less time than it does to locate and correct a mistake later on. After doing a few conversions, the procedure will become automatic.

A trick the author uses is to put a piece of clear plastic wrapping paper over the pages from which he's working. Each step is then marked in grease pencil on the plastic after it's completed. An alternative method is to copy the conversion and work from the copy, making any notes directly on it. This may later be added to the unit's documentation as a record of work done on it. Both methods keep the original neat so that it may be refered to again.

Once the conversion is complete, or at least sufficiently far enough along for testing, comes the moment of truth. This is when one finds out if the set works or not. Note that this doesn't mean "works perfectly". It is only important at this point that it does something more or less like what's expected of it. The fine tuning will only be performed after everything that's to be done to it has been completed. For this, all that's needed is an antenna and a pair of earphones (or a speaker) for a receiver, or a key (or microphone) and a dummy load and output indicator for a transmitter.

Operate the set normally and see what happens. If it works at least close to the way it should then you're in business. If not, then a quick run through with a VOM should point out the problem area. If this fails to locate it, then trace the signal until the problem is located. By the way, it's not considered cheating to enlist the aid of a friend. This is especially true if the same friend has equipment or experience that you lack. As a general rule, though, if the previous checks were made and all was

satisfactory, then the set should operate more or less correctly when it's powered up.

Once the radio's operational, continue through the conversion until all steps are complete (making checks as you go, of course.) At this point, it may be brought up to specifications through alignment, tuning, etc. Transmitters should also be checked for harmonics and parasitics, with neutralization done as needed. Additional filters, such as harmonic or key-click filters should be added at this time. Apply any finishing touches and "window dressing" desired and the job is complete.

There are a few general notes and observations that may be of value. They are based on a quarter century's worth of experience with many types of surplus conversions. They are not hard and fast rules, nor should they be taken as such. Instead, they are handy little hints that have worked for the author over the years.

In any written conversion, it should be remembered that the method used is nothing more than one which has worked for it's author. It is not the only way to accomplish a task, nor is it necessarily the best. Not one conversion has ever been written that is the final word on how to convert a particular set. Even the best is no more than a guide, written from one point of view and done to achieve a particular end. The more popular ones have been so because they were more generally applicable. They may not be at all suitable for a particular application you may have in mind, however. If you see something that will work better for you, by all means do it. This includes conversions for other sets that may be adapted to the one you're working on. Remember that you are the only one who has to be satisfied with the results.

Given a choice of several ways to do something, the best rule of thumb is "Simplest is Bestest.". As long as the same end results are achieved, this does two things. First, it minimizes the time and effort required to make the set operational. Second, it minimizes the changes to the circuits which keeps them operating as close to original as possible and makes trouble-shooting much easier. Keep in mind that military radios were designed by professionals working to rigid specifications and to fill a particular set of requirements. Where there is room for improvement, it's mostly in the differences between military and civilian requirements. The modifications done, therefore, should only answer these differences. Some sets will require more work than others, but that's only because the military and civilian requirements for them are more divergent.

Sometimes a conversion will start out "First strip the chassis." or words to that effect. This is no longer a conversion, but rather is a new design based on the chassis and components found in the set. This is fine and doesn't conflict with the previous paragraph as long as the difference between the two procedures is noted. A conversion is not a redesign, but rather is an adjustment to the design to meet new requirements. At times it may be

difficult to recognize the difference between the two, but the above noted phrase is a good clue.

In checking out a set, either in preliminary checks or in locating faults, aged electrolytic capacitors are the most commonly found problem. More or less in order, the next most common problems are faulty tubes, aged resistors and non-electrolytic capacitors, dirty or corroded contacts, broken wires, faulty inductors, and broken or missing components. (Some technicians replace all the electrolytic capacitors in a unit before doing anything else. The belief is that if they're not bad yet, they soon will be and it's better to prevent a problem than to fix it.) As a general rule, the set's age and general condition will give a good starting clue as to how much work will have to be done. After a while, it will be easy to spot potential trouble-makers, however, in the beginning, it's best to check everything.

If a part is bad and an exact replacement isn't available, try substituting. As long as space is available, resistors and capacitors may be used in combination to replace single units. Exact values aren't necessary as long as the resultant combination is within the tolerance range of the original component. (There are a few critical applications where this doesn't work but they're fairly obvious.) Resistor power ratings and, within reason, capacitor voltage ratings may be higher than the originals, of course. Substitutions for RF and IF inductors are less easily made, however sometimes they may be repaired with care. If not, then check with the surplus houses to see if they have a replacement or can suggest a substitute for the damage inductor. Other sources such as hamfests and local hams with large junk boxes should not be overlooked.

Some sets are just not worth converting. The end results do not justify the time and trouble required to convert them. It is a fairly common occurance, however, that these units have components in them which are worth salvaging. A good example of this is the BC-191 (and its 24 volt counterpart, the BC-375) which came out in 1934. These were large, unstable and power-hungry transmitters that used plug-in tuning drawers. (The drawers themselves were larger than the much more stable and efficient Command transmitters!) These old boxes do have some saving graces, however. The coils, capacitors and switches are capable of handling a lot of power. They may be used as the basis for high-powered amplifiers or antenna tuners without pushing the ratings at all. The meters are valuable, the vernier drives are excellent and even the cabinet may be used as material for an enclosure for projects. In short, these are nice units to latch on to, but not as transmitters. If you wind up with a surplus unit and don't believe it's useful for anything else, look at it for its parts value. With rare exception, this will be quite good.

Sometimes finding connectors for a particular set can be a problem. Usually they're available at the surplus houses, but some are just not available...or at least not when you need them. While

it's best to use the originals when possible, there are several ways around a lack of them. The first way is to solder leads directly to the connector. This has the advantages of being quick, cheap and easy. A big disadvantage is that it hardwires the cable to the device which can present problems. A second way is to use loose pins and receptacles as needed to attach the wires to the connectors. The pins may be stiff pieces of wire and the receptacles those from octal or miniature tube sockets. This makes the cabling removeable and takes little extra time. However, if the cabling is removed often and/or there are a lot of wires, there may be some confusion as to what goes where unless they're clearly tagged. The third route is to replace the connector with an octal tube socket and use the base from a deceased tube as the cable connector. The advantages are that these are generally available and can act as the original connector. On the other hand, it also limits the number of wires to eight, which sometimes isn't enough. Other connectors that may be available may also be used, of course, dependent on what is required. In any case, the correct alternative to use depends on what you need and what you have to work with.

A word of caution about getting tube bases is warranted here. Breaking glass tube envelopes can be dangerous due to flying bits of glass. One method used by the author is to wrap the tube in several layers of newspaper then tap it with a hammer just hard enough to break the glass. After the envelope is broken, open the newspaper to retrieve the base. Using long-nose or duck-bill pliers, pick the rest of the glass out of the base, including the center stem. Do this over the newspaper so the glass falls on it rather than on the floor where it can find bare feet, etc. Once all the glass is out of the base, then roll up the newspaper with the glass inside it and discard it. The old wiring may be clipped off short and the new wires run past it and soldered in place.

CRT envelopes should NOT be broken using the above method. These, especially picture tubes, have a high vacuum and a large amount of glass which combine to create an especially hazardous situation. (Picture tubes may also have a charge on them of well over 10,000 volts and should be bled off before handling them.) If you don't have any experience in handling these tubes then don't do it. Rather find someone who does have the experience and is willing to do it.

Like connectors, mating tuning drives is not always easy. For example, the Command and later A.R.C. type 12 receivers use a spline drive intended for remote tuning. While local tuning knobs were made, they never were plentiful and are just not found today. In this case, tuning shafts are available and one end of a shaft may be cut off for use as an adaptor. A knob may be attached to this "adaptor" for local tuning. This same approach may be used in other cases where tuning knobs aren't available. Where this doesn't work or where shafts aren't available, rubber, plastic or metal tubing may be forced over the end of the spline and used to attach a knob. The tubing may be found in hardware stores and hobby shops in a variety of sizes and wall thicknesses. The only real rule on this

is "Use whatever works.".

Most military equipment uses Bristol (also known as "spline") head screws in place of Allen set screws. These present a problem since spline wrench sets aren't common items. Sets are made by GC, Xcelite and a few other companies and are available through various electronics shops. The proprietor of your local, friendly hardware shop may be able to order a set for you as well. They aren't expensive and can save a lot of trouble and frustration.

Black wrinkle is a "popular" finish for military equipment. Unfortunately, it collects dust and dirt in the wrinkles and is, at best, difficult to clean. Painting over the finish tends to almost fill in the wrinkles unless the paint is thinned almost to the consistance of water. Black liquid shoe polish, on the other hand, restores the color nicely without filling in the wrinkles. (In severe cases, shoe dye also works.) Any panel markings that are covered up in the process may be restored with decals, dry transfers, or a pen and white paint, corrector ink, water color, etc. Carefully done, the set may look new no matter what its age.

Above all else, have fun. Take advantage of the opportunity to experiment and play "What happens if...". Within obvious constraints, it's hard to hurt tubes and if the power supply is properly fused, everything else should be reasonably safe. (The same holds true with semiconductors, although they're less resiliant hence the constraints are tighter.) Don't be afraid to juggle component values around to try to boost performance. As noted before, most military equipment is conservatively designed so that it will last longer under combat conditions. There is some latitude, therefore, in some component values to work with in improving performance. What you learn with surplus may be applied to commercial gear as well, plus new designs if you're so inclined. In any event, enjoy yourself and your hobby.

Chapter 3

Power Supplies

There are two commonly heard statements when reference is made to surplus. The first is "My house is wired for 60 Hz power, not 400 Hz.". The second is "I don't have a 24 volt power supply good for a couple hundred amps.". Both imply that one and/or the other is required to run surplus equipment. They aren't.

A number of very good books and articles have been written on the subject of power supply design. Rather than being "just another chapter on design", this one will look at some practical supplies made from surplus and salvaged components.

A number of receivers may be operated from a power supply delivering 220-250 volts at 60-80 ma. plus 12 or 24 volts for the filaments. A power supply for this application is shown in figure 3-1. The choke input filter arrangement is used to act as a current limiter to protect the diodes when the supply is turned on plus helps regulate the supply some during operation. (The choke input filter is also used since it requires less space and is slightly cheaper to build. While not "good engineering" reasons, they are very practical!) With some care, the supply may be built on a dynamotor mount as a direct replacement. Several transformers have been made with this particular application in mind. (Check in Fair Radio's catalog.)

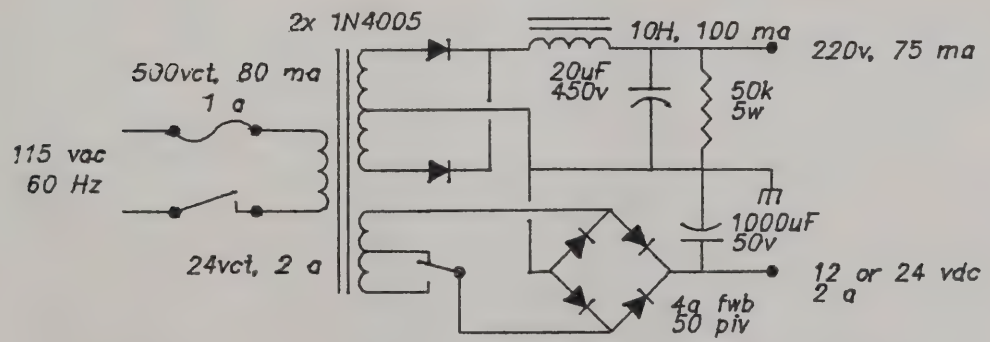


Fig 3-1 Basic Receiver Power Supply

For a bit more current, the supply in figure 3-2 may be used. Again, the choke input filter is used for the reasons noted before. While larger than the supply in figure 3-1, it may be built fairly compactly using careful layout and parts selection. This supply is also useful when a unit that would normally be powered by the supply in figure 3-1 is used with an outboard converter or other add-on. Note that if the receiver being powered uses a 6 or 12 volt filament string, then the extra filament transformer isn't needed.

Several surplus transmitters, like receivers, have the same general power requirements or may easily be adapted to them. These requirements are for 500-600 volts at about 150 ma. and 200-250 volts at up to 100 ma. Note that the lower requirement is very much like that for the receivers. The supply in figure 3-3 will easily handle both functions. If there is a difference between the receiver's requirements and those for the transmitter, then dropping resistors may have to be added to one side of the switch.

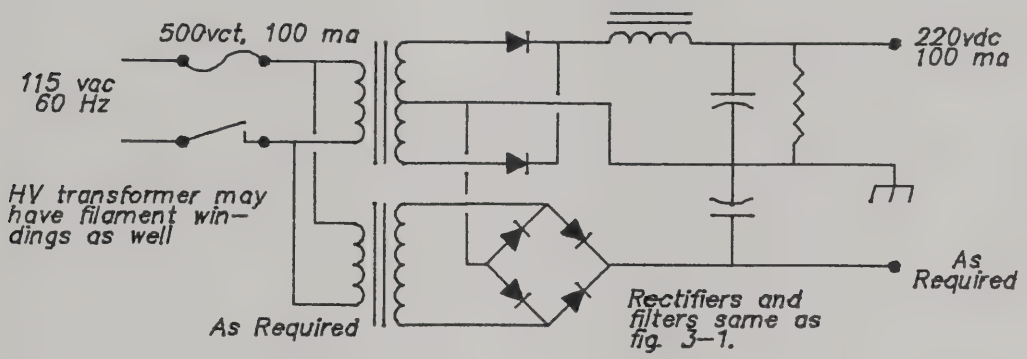


Fig. 3-2 "Heavy" Receiver Power Supply

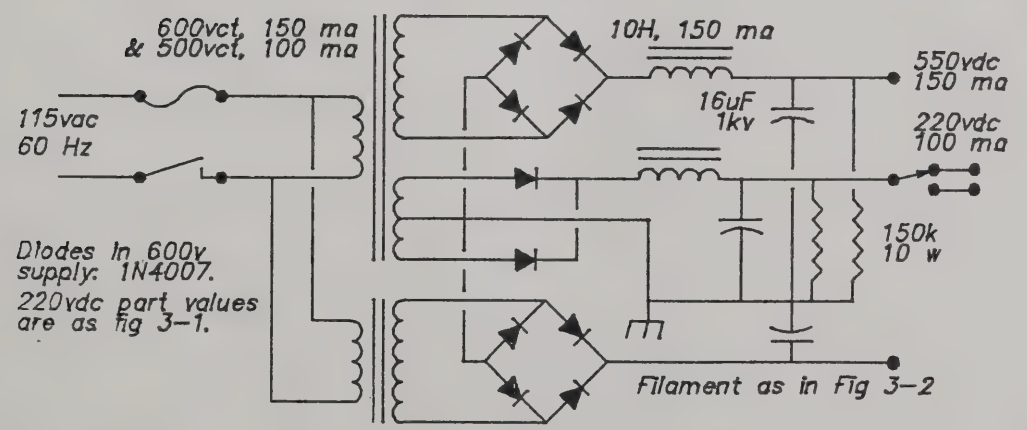


Fig 3-3 Utility Receiver-Transmitter Power Supply

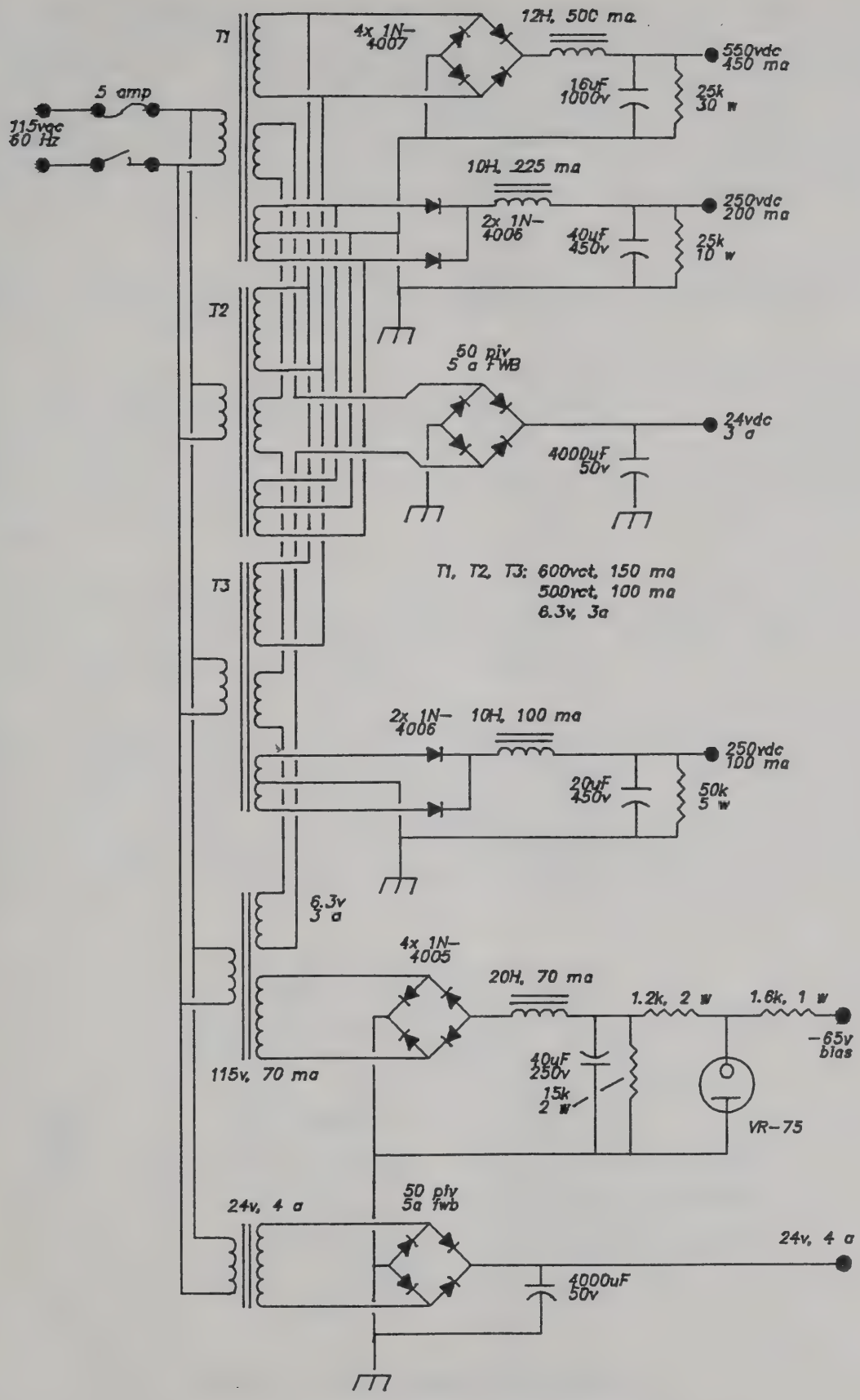


Fig 3-4 Power Supply for Modified Collins 618S-1

The power supply in figure 3-4 is a variation on that in figure 3-3. While it was designed to power a transceiver built from Collins 618S-1 modules, it's nothing more than a high current version of the "utility" supply. Series and parallel combinations are used to satisfy the voltage and current requirements of the unit. It also has an auxiliary source of 250 and 24 volts for powering outboard equipment such as an auxiliary receiver. The bias supply shown is but one way to handle the problem. Another way is found in the next supply.

Figure 3-5 is of a supply designed to power the R-174/URR receiver. In addition to the bias supply, the method of developing the 1.4 volt filament source may be of interest.

The bias supply shown is fairly straight forward. The 86 ohm and 3.3k ohm resistors plus the voltage regulator form a series load for the power supply. The receiver high voltage is a parallel load across the regulator and the combination keeps the current at a constant 50 ma.. This current develops a drop of 4.3 volts across the 86 ohm resistor, which is close enough to 4.2 volts to consider it as such.

Incidently, several sets, such as the RT-77/GRC-9, use a built in battery for a bias supply which also works quite well. The only disadvantage is that the battery has to be replaced periodically, where the bias supply in figure 3-5 doesn't.

The filament supply uses a voltage regulator IC only to provide a stable voltage source for the rest of the circuit. The filament regulator itself uses two silicon diodes between the supply line and ground. The forward voltage drop across a silicon diode is approximately .7 volt. The two together, then, provide the needed 1.4 volts. The resistor between the regulator and the diodes is a current limiter to protect the diodes and the integrated circuit.

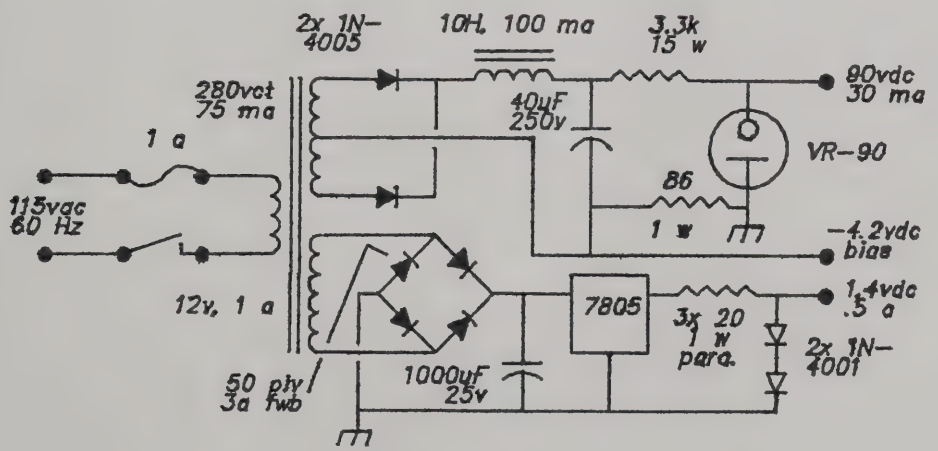


Fig 3-5 Power Supply for R-174/URR

In the supplies shown above, the capacitor and choke ratings are flexible. The capacitor working voltages and choke current ratings shouldn't be lowered, but may be raised within reason. The ratings of the other components may also be adjusted to match existing stock. As noted in the previous paragraph, series and parallel combinations may be used to achieve desired values for capacitors and resistors. Series wired filter capacitors should have balancing resistors across them. (This may be accomplished by using taps on the bleeder resistor.) Likewise, series wired diodes should have balancing resistors across them. (About 470k ohm is fine for this.) With some care and cleverness, practically any supply problem may be met.

Some equipment requires battery supplies. While the newer units require a single voltage (usually 12 volts,) the earlier units needed a filament supply, a plate supply and, in some cases, a bias supply. High voltage batteries are becoming hard to find and, once located, tend to be expensive. There are several surplus batteries available, however, which may be used to help relieve this problem. While the solutions are not perfect, the cost certainly offsets any problems that may crop up.

The BB-51 and BB-52 are lead-acid batteries designed to power the older radiosonde transmitters. (Radiosonde transmitters are balloon-borne units which send pressure altitude, temperature and humidity information to a ground station. Their life expectancy is one mission so they are made as cheaply as possible.) The BB-51 produces 6 volts and is rated for 2-3/4 hours through a 30 ohm load. The BB-52 produces 36 volts and is rated for 3 hours through a 1200 ohm load. Normally they're packaged with one BB-51 and three BB-52s, which collectively is known as a BB-208. The total weight for the package is under one pound. Although they were designed to be disposable, the batteries may be recharged and re-used.

Three BB-52s may be used as a high voltage and bias supply for such receivers as the R-174/URR. For this application, a pair of resistors are used to drop the voltage and set the bias level. Figure 3-6 shows how this is done. According to the ratings, the batteries will last about three hours before requiring a charge. With other units, the dropping resistors required and the useful life will vary, but the method remains the same.

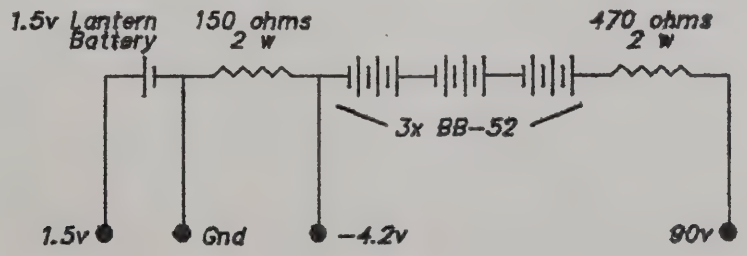


Fig 3-6 BB-52s as Supply for R-174/URR

The BA-316/AM is also a radiosonde battery but of later design. It is a water activated, single use pack which produces 114 and 7.5 volts. The high voltage comes from 76 1.5 volt cells arranged in four packs of 19 cells each. The low voltage source is two packs of five cells each. These packs are wired in parallel and the cells are larger than those in the high voltage packs. The packs are held together with tape and contained in a bakelite frame which is also taped together. The whole package is contained in an open cardboard box. The construction is inexpensive and lightweight due to the purpose for which the battery was designed.

The construction makes the battery easy to "customize". Again for the R-174, three packs from the high voltage source plus one from the fourth will produce 90 volts. Three more cells will produce the bias supply and the 7.5 volt packs may be rewired so all the cells are in parallel for the filament supply. The end result is shown in figure 3-7.

The BA-398/PRC-25 is a mercury battery pack designed to power the RT-505/PRC-25 under arctic conditions. It consists of six packs of ten cells each and one of six cells, and is rated at 15 volts at 1.5 amps and 3 volts at 400 ma. The packs are contained in cardboard boxes and the whole package is housed in a nylon bag.

Like the BA-316, the BA-398 may be easily "customized". The ten cell packs are good for 15 volts at 250 ma. each. By rewiring them in series, a 90 volt battery is produced. The low voltage battery won't handle the filament drain but may be rewired for use as a bias battery. The filament supply may be a 1.5 volt ignition battery, (which also works with the BB-52 supply.) While not rechargeable, this battery is more convenient since it requires neither water nor acid. The convenience comes at a price, however, since the BA-398 is not as inexpensive as the other batteries.

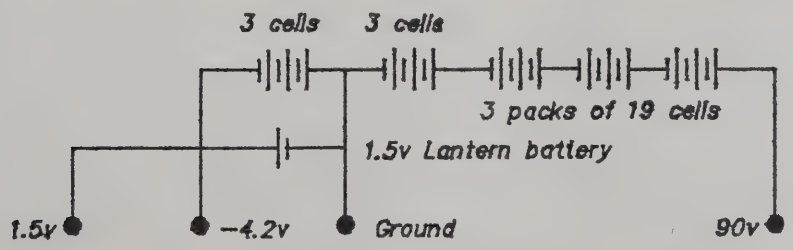


Fig 3-7 BB-316 as Supply for R-174/URR

Like the BA-398, the BA-279/U is an easily customized battery. This one was used to power the AN/PRC-8, -9 and -10, and puts out 1.5, -1.5, -6, 67.5 and 135 volts. Each voltage comes from a wax-sealed cell pack made up of 1.5 volt cells. (The 1.5 volt packs have cells larger than the others due to the higher (filament) current requirements and, in these, the cells are paralleled.) The cell packs may be used intact or may be easily broken down and recombined to build batteries for virtually any voltage, not unlike the BA-316.

The last supply to be mentioned is one suggested by Fair Radio Sales for powering the AN/PRC-8, -9, and -10 transceivers, and replaces the original battery pack. Common parts are used, making it easy and inexpensive to reproduce. The schematic for this supply is shown in figure 3-8. Note that, by changing the dropping resistor network, the supply may be used to power other sets as well.

The ideas presented in the previous paragraphs are just a sample of what may be built to power surplus. There are some supplies already built, however, which may be used for powering surplus equipment. Many are themselves military surplus while others are commercial units "retired" from service in computers and elsewhere. A few of these are described in the following paragraphs.

Many of the logic supplies currently available have, in addition to a 5 volt output, an output for 12 or 24 volts, or both. The current rating on these higher voltage outputs range from a fraction of an amp to over 60 amps. The lower current ones are quite useful for handling the low voltage requirements of the older surplus gear. The newer equipment which operates from 12 or 24 volts may be powered directly from these supplies. The vast majority of these supplies are regulated with some adjustment range in the output voltage. The cost is low enough that they're often less expensive than a home-made unit of similar ratings. It should be noted that they higher current logic supplies use oscillators as part of the regulator. They can and do interfere with recievers unless they're adequately shielded and filtered for rf.

The military also has some low voltage supplies for powering some of the vehicular and field radios from the power mains. Among these is the PP-894/GRC-32 which produces 27.5 volts at 20 amps. It was originally designed to power the RT-178/ARC-27 when it was used as a ground installation set. This same power supply, with some added filtering, may be used to power such sets as the RT-671/PRC-47, which requires 27.5 volts at about 12 amps.

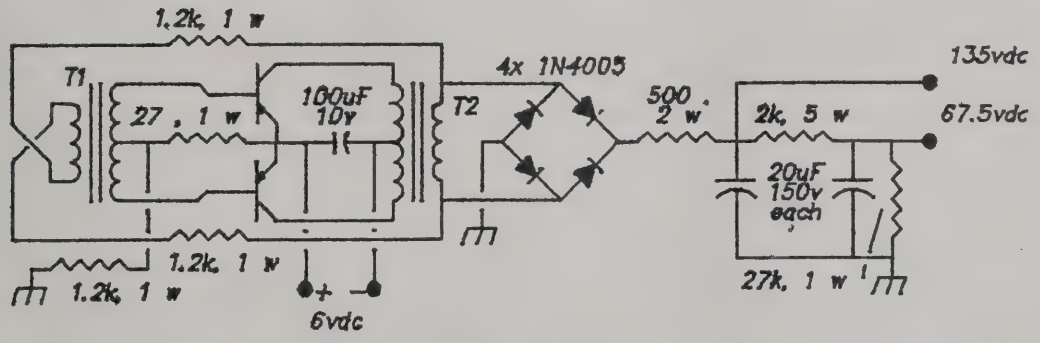
While there is a variety of surplus high voltage supplies, a few are useful for a number of sets. Two of these supplies are the DY-94/GRC and the PE-110.

The DY-94 originally was used with the AN/GRC-10 system. It produces 550 volts at 150 ma., 250 volts at 120 ma, 200 volts at 100

ma., 20 volts at 20 ma., and 26.7 volts at 1.7 amps. Early units used a dynamotor and vibrator supply for operation from 24 volts dc. Later ones, called the DY-94A, had a semiconductor inverter which powered the ac supply, thus saving quite a bit of weight. The combination of outputs may be used, directly or with some dropping resistors, to power the old Command sets, the AN/GRC-9, and other similar sets. Some transmitters, such as the Bendix TA-12, may be modified to run on this supply while it also supports a receiver like the TCS or the R-648/ARR-41. This is one of the most useful supplies to come up as surplus.

The PE-110 is an older supply and was originally intended to power the BC-669 transmitter-receiver. The high voltage section of this unit produces 520 volts at 420 ma.. This output may be used to power the Bendix TA-12 or handle the high voltage requirements of the Collins 618S-1 (and its variants). Alternatively, the transformer and parts from the filter circuits may be used in a voltage doubling or tripling supply for rigs using tubes like the 813, 4X150, etc. There is sufficient reserve built into the supply that temporary overloads from output peaks in a sideband transmitter or a key-down condition on a cw transmitter won't do any damage. As a note, there is also a vibrator power supply built on a separate chassis mounted on the PE-110's main chassis. This may be removed to allow space for a low B+ or filament supply if desired.

While other supplies are available, the ones mentioned are probably the most generally useful of them. As with the "generic" supplies described earlier in the chapter, variety through modification and selection yields a supply for nearly every need.



T1, T2: 12.6vct, 1.2 a
XSTRs: 2N173

Fig 3-8 DC-DC Converter for AN/PRC-8, -9 & -10

Chapter 4

Some Old-Timers Revisited

Two unrelated events happened after the end of World War II which furthered the cause of conversion as nothing else could. First, amateur service was restored after being suspended for the duration of the war. Second, tons of electronics were released as surplus and came on the market at pennies on the dollar of original cost.

A number of amateurs had dismantled their stations during the war due to the shut-down of amateur service. They now needed equipment and, recognizing the bargain represented by the military equipment, dug into the piles hungrily. Other amateurs still had their pre-war stations but saw surplus as a way to upgrade and modernize what they had. Still others were just getting into ham radio and were attracted by the low prices on the equipment. There were also the experimenters who wanted the equipment to "play" with. Finally there were the shortwave listeners who found the military receivers to be truly excellent units. The surplus phenomenon lasted some 15 to 20 years and produced some very interesting and unique conversions.

Several pieces of equipment became instant "hits" with amateurs. A few were because they were useable with little or no work. Others, while just as useful as the first group, required more work but were marvelously adaptable and inexpensive. These latter units became the targets for amateurs' fertile minds and were made into nearly everything conceivable - most of which worked. Let's take a look at some of these old friends.

Beyond any question, the most popular units were those collectively refered to as the Command sets. These were the Navy ATA/ARA, the Signal Corps SCR-274-N and the joint services AN/ARC-5 systems. They were found in nearly every U.S. combat aircraft plus other installations. Generally, the systems consisted of five each transmitters and receivers, collectively covering 2 to 9.1 mHz and .19 to 9.1 mHz respectively. There were also several transmitters which extended the coverage down to 500 kHz and a few receivers in the 9 to 20 mHz range. These units were never made in any quantities and are rarely seen outside of collections. In addition, there was one each transmitter and receiver which covered 100 to 156 mHz on four crystal controlled channels. (The HF units were all tuneable.) The HF transmitters were a simple MOPA (Master Oscillator - Power Amplifier) design which had two parallel 1625s in

the P.A.. (A 1625 was a 12 volt version of the 807. It was very popular for use in designs during the war.) They tuned with one knob controlling both the oscillator and the P.A. plate circuit plus used a roller coil for antenna matching. The receivers were six tube units and, like the transmitters, were nicely compact and stable. These units were still in limited service in the sixties and the LF receivers even later than that. The receiver design, first developed in the thirties, was the basis for the A.R.C. Type 12 sets, some of which are still in service.

Unmodified, two of the transmitters covered amateur bands directly, hitting the 80 and 40 meter bands. The other three were easily modified to cover 160, 80 and 40 meters. (one of the rare transmitters, the T-18/ARC-5, covered 160 meters directly.) In addition, each band was covered by a separate receiver, making it possible to make a set of single band rigs with little difficulty. The transmitters were easily converted to crystal control, making them attractive to the Novices. (Novices were limited to 75 watts input and crystal control originally.)

The Command transmitters weren't perfect however. They had some bad habits - click, chirp, drift and the occasional bit of TVI. To make things worse, the sets were unpredictable as to which one would do what. Quite a few articles were written on how to solve these problems, either singly or collectively, which ranged from the simple to the complex. Most often (in the author's experience,) the simple changes worked the best. For the TVI, these were a small number of bypass capacitors plus some window screen to cover the holes in the cabinet. (As with any station, a low-pass filter was strongly recommended.) For the keying problems, a bit of common sense applied to the existing keying circuit worked wonders. The drift problem was only a problem when the oscillator was left on in CW, which it wasn't in the original design. Regulating the oscillator B+ also helped cut the drift and eliminate any chirp found. Overall, the transmitters could be cleaned up in a week-end.

Like the transmitters, the receivers had some proplems. The tuning rate was fast and the pass-band was wide. They were fine for local ragchewing, but when the bands were crowded, their usefulness was limited. The tuning rate was most often slowed down by removing plates from the tuning capacitors and padding them to hit the bands. The BFO was often converted to a heterodyne oscillator and mixed with the IF signal with the resultant signal routed to an external tight IF unit, such as the IF of one of the LF receivers. Neither of these was very involved and could easily be accomplished in an evening or two.

Other conversions for these sets extended them to other bands and modes, and became more ambitious and complex. Transmitters became receiver front-ends and receivers became heterodyne exciters. There was, for all practical purposes, no limit to what was done with these sets.

The single most popular unit of the series (and, handily, the most plentiful) was the 190 to 550 kHz receiver. Their initial use for amateurs was as an outboard IF strip with a tight bandwidth. (This was known as a "Q-5er".) This made a passable receiver into a hot CW unit capable of pulling a signal out of the mud and muddle. This conversion took an evening in its simpler forms to a weekend or two in the more complex ones. Later, these receivers were used as tuneable IF stages for use with HF converters which achieved the same end with less hardware. A late conversion made the receiver all semiconductor, with all the attendant heat, power and noise figure improvements.

Overall, the Command sets were a decent group of sets due to their versatility and simplicity. Not all of the possibilities for these sets have been exhausted, especially with the new bands opening up, so they still have potential to be useful.

The Collins-designed T-47/ART-13 (or ATC, as the Navy called it,) was another popular surplus rig. In its basic form, this transmitter covered 2 to 18 mHz in 12 continuously tuneable bands or on ten auto-tuned channels. The P.A. had an 813 modulated by two 811s and was rated at 100 watts output. The antenna network could match nearly anything in the line of an antenna. It was an excellent running rig and, while not small, it was considered compact in its day. It was also a good looking unit and needed no "help" in dressing up a ham shack.

Most versions also had an LF VFO covering 200 to 600 or 200 to 1600 kHz, dependent on model and service. A later version, the T-412/ART-13B, had ten crystal channels in addition to the auto-tuned ones plus four more in the 200 to 600 kHz range. While designed for use on large aircraft, the Navy had a shipboard version of the transmitter known as the TCZ. After the war, several airlines bought ART-13s for use on routes where high powered HF equipment was of use. Like the Command sets, the ART-13 saw limited service into the sixties.

The only thing needed for this rig to get it on the air was to put power to it. The original design called for 1100 volts on the plate of the 813, however several conversions pushed this up to around 2000 volts. The keying system needed help in two areas, these being an occasional chirp and a noisy keying relay. The first was solved (when needed) by regulating the oscillator screen voltage. The second was handled by using alternate keying methods if the noise was objectionable.

While FSK and SSB conversions have appeared, the largest number of conversions concentrated on extending the frequency range of the set. This was usually done by adding a multiplier stage and a second output network. The cleverest of these, however, retuned the set to cover 3.4 to 30 mHz continuously, thus keeping the original design philosophy. Due to the excellence of design and rugged dependability of these sets though, most of the conversions left as much of the original circuitry alone as possible.

The receiver most often used with the ART-13 was the BC-348. (The Navy used the ARB in some installations and the R-105/ARR-15 was used in later ones.) Collectively, these were known as the AN/ARC-8 and were used in patrol aircraft, bombers and other aircraft requiring long range HF communications.

The BC-348 was a communications receiver covering 200 to 500 kHz and 1.5 to 18 mHz in four bands. The circuitry was conventional although the negative side of the power supply was left floating to provide bias to several stages. It was a sensitive unit and had a crystal in the IF for additional filtering. The IF was 915 kHz and, in spite of the crystal, was somewhat broad. The receiver had a built-in dynamotor and operated from 24 volts dc. There was a 12 volt version, the BC-224, which was otherwise identical. The BC-224 is not often seen since it was never built in any great quantities.

The most basic conversion done to this set was to replace the dynamotor with an ac power supply. This could be accomplished in an evening with enough time left over to enjoy the set. Like the Command sets, a large number of the conversions dealt with slowing down the tuning rate and narrowing the bandwidth. Both were accomplished in much the same way as with the Command sets, although some of the narrow IF strips were mounted inside. The crystal was also improved, most often by just cleaning the mount. The set was also converted to all semiconductor operation as well. With minimum conversion, this was a decent auxiliary or SWL receiver. When the tuning rate and bandwidth were improved, it became a reasonably hot amateur unit.

The BC-312 and BC-342 were sometimes refered to as being the ground versions of the BC-348. They were, however, a completely different design. They covered 1.5 to 18 mHz in four bands and had a 465 kHz IF. The BC-312 operated on 24 volts dc and the BC-342 operated on 115 volts ac. Both were, like the BC-348, AM and CW units, although the BC-342 was used in some of the early RTTY installations. Some models had crystal filtering in the IF and the early models had provision for a noise antenna as well. The sensitivity and selectivity were both good. The tuning rate, while better than the BC-348, was still a bit fast.

The only conversion really required was, like the BC-348, to replace the dynamotor in the BC-312. Since space was cramped, this often wound up being an outboard supply. The switch for the crystal phasing was sometimes reversed on the control to provide a more smooth transition from filtered to unfiltered operation. Like with other sets, the addition of a Q-5er or Q-multiplier didn't hurt at all.

As noted in chapter 1, several civilian units were pressed into military service. Notable among them were the Hammerlund Super-Pro and the National HRO.

Several versions of the SP-200 and SP-210 Super-Pro receivers

were used by the military. These were the "LX" which covered 100 to 400 kHz and 2.5 to 20 mHz, the "SX" which covered 1.25 to 40 mHz, and the "X" which covered 540 kHz to 20 mHz. These were known as the BC-779, -794 and -1004 respectively. All of them required external ac power supplies, which were the RA-74, -84 and -94. They could also be battery operated, although the current drain was a bit heavy for extended battery operation. The IF was 455 kHz and there was a crystal in the IF for filtering plus a variable bandwidth control. These were rack mounted receivers, intended for shelter or fixed base operation.

The National HRO, as designed, covered 100 kHz to 30 mHz using plug-in coil sets. The Navy used these sets over the range of 1.5 to 30 mHz and called it the RAS. Other military versions existed as well. While not as sophisticated or as complex as the Super-Pro, the HRO was one of the top receivers of its day. Like the Super-Pro, it had a 455 kHz IF and required an external power supply. The circuitry was straight forward and was extremely reliable.

No conversion was required for either set to put them into operation. A few articles were written on them, mostly adding product detectors and other minor changes. Even unconverted, these were some of the finest receivers to come out of the war.

The VHF and UHF equipment available at the end of the war did much toward opening the 6 through 3/4 meter bands. Like the HF equipment, these were quality units available for practically nothing, bringing the upper bands into reach economically. While the communications equipment was crystal control for both transmit and receive, the crystals were readily available and the receivers were easily made tuneable.

By and large, the communications equipment was already on 2 meters. The few units that weren't were close enough that the modifications required were minor. There were a few IFF (Identification Friend or Foe) units that operated between the 2 and 1-1/4 meter bands that could be modified to either band and some radar equipment operating in the 3/4 meter band. The 2 meter transmitters were modified for every band between 10 and 3/4 meters, and had CW, FM, DSB et cetera added to their talents. The 3/4 meter equipment also had ATV included through some very simple changes. The VHF receivers weren't as extensively modified, the more usual track being to use band convertors feeding an HF receiver.

Basically, all the communications equipment was the same as far as specifications were concerned. The transmitters all had an 832 in the power amplifier and were rated at 10 to 15 watts output. Except for the AN/ARC-1 (which will be discussed in a bit), they all used crystals in the 8 mHz range to hit 2 meters. The receivers also used crystals around the same range, but with variations due to the different IFs used. The AN/ARC-1 and AN/ARC-4 had, in addition to their regular receiver, an extra receiver section called a "Guard" receiver. This was used to monitor a separate frequency

from the one the regular receiver and transmitter were tuned to. Due to similarities between the sets, the conversions were similar, and will be covered as a unit.

With the possible exception of the VHF Command sets, the SCR-522 was the most popular of the VHF sets. This system was based on a British design and was built by Bendix, Colonial and a few others for use in U.S. aircraft operating from England. It consisted of a separate transmitter and receiver (the BC-625 and -624 respectively) mounted in a common frame, and operating on four channels. The design was reasonably straight forward and had no unusual "quirks" or bad habits. Metering jacks were provided on both chassis for tune-up. Dynamotors were made for both 12 and 24 volt operation, and there as an ac power supply for 115 or 230 vac operation. The transmitter and receiver had essentially the same power requirements.

The only unique problem in this set was the tuning mechanism. The original channel select system was in the mounting frame and operated tuning shafts for the various stages. On the transmitter, this was one shaft for each tuned stage while the receiver used two shafts. These were for the RF stages and the oscillator chain respectively. Various methods were used to handle this multitude of controls, each having its own advantages and disadvantages.

Soon after the U.S. entry into the war, Western Electric designed a VHF set which would fit into the Command set racks. While the original designs were rejected, a second attempt was made which eventually became the T-23 and R-28/ARC-5. Functionally equivelant to the SCR-522, these were a more modern design and provided equal or better performance in a more compact package. Each unit had its own channel select drive, the transmitter using different tank circuits for each channel while the receiver used cam operated stops. While the receiver could have any channel anywhere in the tuning range, the transmitter's tuning was such that each channel only covered part of it. As a result, only the top two channels could hit the 2 meter band, and only the top one covered it completely.

The RT-19/ARC-4 was another Western Electric design. (It was also known as the WE-233 when used in civilian "dress".) This was a four channel transmitter-receiver covering 140 to 144 mHz. The guard receiver (mentioned previously) covered the same range. The unit had a built-in dynamotor for 12 or 24 volt operation, and fit into a standard 10-7/8 inch mount.

Like the RT-19, the RT-18/ARC-1 was a self-contained transmitter-receiver which fit a standard 10-7/8 inch rack. It was, however, a ten channel unit, with some 50 channel models built as well. One oscillator was used to tune both the transmitter and receiver. It had an auto-tune system which operated three tuning shafts, one each for the transmitter, the receiver, and the antenna circuit. All three were preset from the front panel and gang-tuned their respective section. The RT-18 had a built-in dynamotor and

guard receiver, and was over-all a more sophisticated design than the RT-19.

The AN/ARC-3 was a transmitter and receiver pair used in aircraft and ground vehicles into the sixties. It, the AN/ARC-36, the AN/ARC-49 and the Canadian ARC-502 were essentially the same except for channel counts, which were 8, 16, 48 and 24 respectively. The ARC-3 was the most plentiful of the sets and consisted of the R-77, the T-67, and a dynamotor power supply. Physically larger than the previously mentioned sets, it was a more advanced design over them. Both units had an auto-tune system which required no presetting. (The receiver had a thumbwheel which prevented it from tuning on the wrong harmonic, but this only controlled a lock-out rather than doing any tuning.) When a channel was selected, the auto-tune motor started and ran until resonance was reached. The motor then shut off and the auto-tune drive locked in place. To change a channel's frequency, therefore, it was only necessary to change the crystals and adjust the receiver's thumbwheel, if necessary.

All of the basic conversions required for the VHF equipment were essentially the same, with variations for differences between the designs. They involved getting power to the sets, tuning the transmitters into the ham bands and making the receivers tuneable. Most also had audio improvements and some detail conversions like front panels, added filters, etc. Band changing in the transmitters was usually no real problem and involved just modifying the multiplier chain and the PA tuning network. Modulating the oscillators was employed to make the sets FM, although this usually resulted in wide-band FM, where current practice is to use narrow-band. The PAs were double-ended which made conversion to DSB very easy. The receivers were made tuneable by either making one stage of the oscillator chain self-excited or by adding an outboard tuneable oscillator feeding the crystal oscillator. Few conversions were done altering the frequency range or mode of the receivers, although these were within the range of possibilities for these sets.

Each of the sets had special characteristics which made it a candidate for special treatment. Both the ARC-1 and the ARC-4 were compact units (for their day) so they were converted to desk-top rigs. The ARC-1 was also the only one given a tuneable transmitter since the same oscillator controlled both the transmitter and the receiver. The ARC-3 receiver, with the oscillator made self-excited, could be made into a "signal seeking" receiver with some very minor alterations. While never specifically mentioned, the auto-tune system allowed both the transmitter and the receiver to track external VFOs so tune-up was never necessary. The ARC-5 transmitter's tank system allowed it to be used on several bands. The circuits not used on 2 meters were converted to 10, 6 and 1-1/4 meters, although it wasn't impossible to put the rig on 3/4 meter as well. The SCR-522 was a good test bed since it was relatively easy to work on. This was also used on various bands as well and was one of the few converted to DSB.

A large number of other sets showed up as surplus but never achieved the popularity of the ones discussed in the previous paragraphs. This was for several reasons such as low availablilty, inherent weaknesses, lack of adaptability, or just plain bad luck. Some of these sets were written up once or twice and forgotten while others were never covered. The list of sets is rather long, however several of these units are mentioned in the following paragraphs.

The BC-652 receiver and BC-653 transmitter were used together in vehicular installations. The receiver covered 2 to 6 mHz in two bands, operating on both AM and CW. The IF was 915 kHz and was fairly broad. A rather unique feature (for that time) was a built-in 20 and 100 kHz calibrator. The transmitter covered 2 to 4.5 mHz in two bands, either continuously tuneable or on four preset channels. The PA had two 814s and was rated at 50 to 90 watts output. The output circuit was an L-network and could load a wide variety of antennas. Both units had built-in 12 or 24 volt dynamotors and were very ruggedly built. While the transmitter was on the large side, the receiver was of reasonable size.

At least two conversions were done on the receiver altering it to ac operation. One of these also converted the upper band to cover 40 meters as well. The IF bandwidth was not directly addressed, although the same alterations done to the BC-348 would work here as well. The transmitter operated on 80 meters with no conversion however needed some work to put on 40 meters. The control system was a bit much and required simplification (and, due to the relays, quieting) for amateur operation. There was no ac power supply made for this set so one would have to be produced for it.

The BC-610 was a 2 to 18 mHz transmitter designed by Hallicrafters for use in fixed and shelter mounted sites. By itself, it operated on AM and CW, and with the AN/TRA-7 equipment, operated on RTTY. The frequency range was covered using plug-in tuning units and PA coils. The PA had a 250TH modulated by two 100THs and was rated at 400 watts output. While based on the prewar HT-4 amateur transmitter, the BC-610 was operated into the fifties.

The BC-610 was a large and heavy unit, however required virtually no conversion for amateur operation. It ran from 115 vac and could be controlled locally. It did have some problems, however. It was a TVI generator and wasn't as stable as amateur practices called for. Neither problem was difficult to remedy, however, and a number of these sets were used by amateurs after the war.

The Navy TCS transmitter and receiver set was used on landing craft, vehicles and shore installations into the sixties. Both units covered 1.5 to 12 mHz in three bands, either continuously tuneable or on four crystal channels. While they were a pre-war Collins design, these units were stable and, for the era, compact. The receiver had a 455 kHz IF and reasonable bandwidth. The

transmitter had two 1625s in the PA and was rated at 10 watts output. An unusual feature of the design was that, while both tubes were used for CW, one was disabled for AM operation. The output network was very flexible and would tune nearly any antenna. As a unique side note, the TCS is very popular with the Japanese amateurs!

Operated unconverted, the transmitter was good for about 40 watts input on cw and 20 watts on AM. With little effort, this could be raised to around 80 to 90 watts on CW. The 80, 40 and 30 meter bands were already covered, with conversion possibilities for other bands. The transmitter did chirp and drift a bit, neither of which were difficult to fix. Sufficient space existed inside the receiver for converters and, with careful design, a power supply. The bandwidth could be narrowed by conventional methods, and the tuning rate on both units wasn't difficult to slow down if necessary. The overall quality of the sets made the needed changes worth the effort.

The Bendix TA-12 transmitters were a series of units virtually identical except for frequency range. They covered 300 to 600 kHz and from 3 mHz to between 7 and 12 mHz, dependent on the model. The range was covered in four bands, each having its own oscillator and PA tuning controls. All except two models operated on 24 volts, the two exceptions being 12 volt units. The series operated on AM, CW and MCW and was rated at 40 watts output from a pair of 807s. The dynamotor and modulator were mounted together on a separate chassis.

While the basic design was old, these were compact units suitable for desk-top operation. All models covered 80 meters, most covered 40 meters and two covered 30 meters. While the set could be operated as is, stability was improved by regulating the oscillator B+ line. The tuning circuits not hitting a particular band could be modified to do so and, by removing the unused components, space existed to add multiplier stages for higher bands. There was a panel-mounted metering jack in the PA cathode circuit convenient for CW keying and another in the driver cathode circuit useable for other things.

All of the units mentioned above are or have recently been available on the surplus market. Most appear at hamfests at prices ranging from reasonable to bargain to free, and in a variety of conditions. None have lost their usefulness through the years and they still represent a good inexpensive way to get on the air.

In chapter 7, there is a list of conversions for a number of these sets. While it's not complete, it does provide a good overview of what has been covered and to what extent.

Chapter 5

Newer Radio Equipment

A number of newer pieces of equipment have become available since the original post-war flood. These are later design units, replacements for the ones discussed in chapter 4 as well as some replacements for those replacements. While it's recent gear, with design dates in the fifties and sixties, it is a general improvement over the older units. By and large, the stability, sensitivity, selectivity, et al are better, the packages more compact and special features more numerous.

All is not rosy, however. The trend in aircraft HF equipment has been toward remote control, resulting in few, if any, panel controls. As mentioned in chapter 1, ground tactical radio has been reduced significantly on HF with the move to FM in the low VHF region. As a result, the amount of directly convertable HF equipment has reduced significantly. Both ground and air VHF and UHF radios have become channelized, using either crystals or synthesis. The overall result is that the effort required to convert surplus has increased, but the higher quality of the equipment has made the effort worthwhile.

A few of the newer sets are mentioned in this chapter. This is, by no means, an all inclusive list, but rather is a representative sample of what may be found. A fair quantity of Aircraft Radio Corporation (A.R.C.) and Collins aircraft equipment is mentioned as well as some of the more common field sets. The reason is not favoritism on the part of the author, but rather is somewhat of a proliferation of these sets on the market. Where, in the previous chapter, a conversion is mentioned, it has been done and published somewhere. This follows through in this chapter, however there are much fewer of them. Let's look at some of the sets. (As a note, units which are still in service at the time this is being written will be described in the present tense. All others, as was done in the previous chapter, will be described historically - that is, in the past tense.)

Even though the AN/ARC-5 series was still in limited service into the sixties, A.R.C. designed two replacements for it in the early and mid fifties. The first was actually a set of civilian radios, the Type 12 series, which were pressed into military service during and after the Korean War and given military designations. The second was the RT-427/ARC-39, which was a low powered HF transceiver.

The Type 12 sets included four receivers covering 190 to 1500 kHz and 108 to 148 mHz, two transmitters covering 108 to 148 mHz and a transverter covering 228 to 258 mHz. Two receivers, the R-11 and 10, corresponded directly with the R-23 and R-24 in the AN/ARC-5 series. (The R-10 was later replaced by the R-22, which differed mostly in the front panel connector arrangement.) The other two receivers, the R-15 and R-19, covered 108 to 136 and 118 to 148 mHz respectively, replacing the R-28/ARC-5. The two transmitters, the T-11 and T-13 (which covered the same frequencies as the R-15 and R-19 respectively), replaced the T-23/ARC-5. The TV-10 transverter was a complete transmitter plus a receiving converter designed to operate with the R-19. There were both 12 and 24 volt models of all the units, with the 24 volt ones being more common.

The receivers were all single band units, like the older Command units, and appeared much like them. Unlike the older sets, they lacked a BFO and were designed strictly for remote control, hence lacked a dial. A.R.C. used a diode-wired triode for a detector in these which, although not commonly found but a very old "trick" for them, works very well. Some of the military VHF receivers had a squelch control, however most weren't so equipped. Overall, the designs were an upgrade from the Command sets on which they were based.

The transmitters were less than half the size of the Command HF units. (The VHF transmitters, while fitting the same racks as the HF units, were larger than them.) They were five channel, crystal controlled sets capable of covering a 2 mHz spread without retuning. The early ones used all 6AQ5s and were rated at less than 2 watts out. The later versions used 5763s and were rated at over 2 watts out. As originally designed, power was supplied by the receiver dynamotor, with switching done inside the transmitters.

The TV-10 also covered a 2 mHz spread, however was an eight channel unit rated at about 1 watt out. The receiving converter had no RF stage, but rather mixed the incoming signal directly with a 110 mHz local oscillator and down-converted to the R-19's range. It was about the same size as a receiver however had no dynamotor mount since it also derived its power from its companion receiver.

A relative of the Type 12's was the Type 15 navigational sets. These were the early VOR (VHF Omnidirectional Range) units. The receivers were essentially improved and modified R-15s. The first of the series was the R-13 which, like the R-15, was tuneable. The last one (and the last receiver of the "Command" type) was the R-34, which covered 108 to 126.9 mHz in .1 mHz steps using crystal control. These receivers operated with the B-10 converter, which converted the receiver output for use with a VOR indicator. The receiver and converter went into a rack much like a dual Command receiver rack.

As noted previously, the military attached their own designations to these sets. The 12 volt R-11 and R-19 became the

R-510/ARC and R-507/ARC. The 24 volt R-11, R-15 and R-19 became the R-511/ARC, R-509/ARC and R-508/ARC respectively. The 12 volt T-11 and T-13 were redesignated as the T-365/ARC and T-363/ARC while the 24 volt models were called the T-366/ARC and T-364/AR. The 24 volt TV-10 was the CV-431/AR. The 24 volt Type 15 equipment became the AN/ARN-30, with the R-13, R-34 and B-10 designated as the R-445, R-1021 and CV-265 respectively.

While designed for use in light aircraft and helicopters, some of these sets found their way into heavier aircraft. They were sometimes used with other radio systems such as the HF AN/ARC-5 sets and some of the early airborne FM gear. In both civilian and military attire, some of these sets were still operational in seventies.

Several conversions were written for these sets and are listed in chapter 7. The R-11 was made into a Q-5er, like the R-23/ARC-5. The R-13, R-15, R-19, T-11 and T-13 were converted to 2 meters and the T-11 was also converted to 6 meters. The TV-11 was made into a 1-1/4 meter set, although the lack of an RF stage in the receiver limited its usefulness. None of the conversions was extensive or difficult.

Several of the VHF aircraft radios lasted into the sixties as did the Type 12 sets. These were kept to allow communications with civilian facilities after military communications moved to the 225 to 400 mHz band in the fifties. The original .1 mHz channel spacing in the UHF band gave way to a 50 kHz spacing which finally was replaced by a 25 kHz spacing. A few of the sets are covered in the following paragraphs. This is by no means an exhaustive list, but is representative of what was used.

The AN/ARC-73 was a remote controlled set having a separate transmitter and receiver. The T-879 transmitter covered 116 to 149.95 mHz while the R-1123 receiver covered 108 to 151.95 mHz, both in 50 kHz steps. While the receiver covered the air navigational frequencies, this wasn't used in all installations. The transmitter was rated at 20 to 25 watts output, dependent on frequency. The complete set weighed around 30 pounds and required 24 volts dc at 20 amps to operate.

The RT-857/ARC-134 is a more recent set and is actually a Wilcox 807A in military trim. It covers 116 to 149.95 mHz in 50 kHz steps and is rated at 25 watts out. Like the AN/ARC-73, it's a remote controlled set, however is ten pounds lighter, and the transmitter and receiver are in one piece. The AN/ARC-134 requires 24 volts at 21 amps to operate.

The Type 12 sets were designed to operate in light aircraft and helicopters. They were replaced in this type of installation by, among other sets, the AN/ARC-115. This transceiver covers 116 to 149.975 mHz in 25 kHz steps. It's a smaller and lighter set, being a seven pound, panel mounted package. Two feature on this set not found on those mentioned previously are a guard receiver tuned to

121.5 mHz and a retransmit capability. This latter allows the signal received by the set to be re-transmitted through another AN/ARC-115, or through an AN/ARC-114 or AN/ARC-116. (Both of these latter will be covered later in this chapter.) The AN/ARC-115 required 24 volts at just over 3 amps to operate and is rated at 10 watts output.

The UHF Type 12 equipment (the TV-10 transverter with the R-19 receiver) were also put into light aircraft and called the AN/ARC-60. Larger aircraft, on the other hand were equipped with such sets as the RT-178/ARC-27 and its non-pressurized counterpart, the RT-349/ARC-55. These sets were electrically identical Collins designs and were fairly representative of the sets in use at the time. (The RT-349 was made by Motorola, incidentally.) They tuned the 225 to 399.9 mHz band in .1 mHz steps and were rated at 15 watts output. A guard receiver tuned to 243.0 mHz was included in these radios which was tube type in early versions and semiconductor in later ones. These sets were remote controlled and operated from 24 volts dc, with a built-in dynamotor providing the high voltage.

Very little has been written on these sets. The semiconductor guard receiver and the PA module have both been converted to 1-1/4 meters, however little if anything has appeared on the entire set.

The RT-295/ARC-45 was a later design radio used in light aircraft. It also covered 225 to 399.9 mHz however operated on 12 crystal controlled channels. This was a compact, remote controlled set, and used subminiature and planar triode tubes. Like the AN/ARC-60, it was rated at about 1 watt output.

The frequency control on the RT-295 was unique and used two sets of crystals. The first set of crystals was plugged into the front of the set and set the whole mHz part of the channel frequency. The second set of crystals was built into the set and consisted of two groups of ten crystals for the .1 mHz part of the channel frequency. (One of these groups was for the transmitter and the other was for the receiver.) The proper crystal pair from this set was selected by a drum switch on the front of the set which was programmed when the channels were being tuned up. This allowed the full 1750 channel range to be covered with only 175 crystals, thus cutting inventory requirements.

Another set which came out about the same time as the AN/ARC-45 was the AN/ARC-48. This was also a UHF set and operated on four crystal channels. It was unique in that each channel used a plug-in module containing the transmitter and receiver RF sections. The common audio, power and control circuits were contained in the main chassis. It also was remote controlled and was a bit larger than the AN/ARC-45. A very unique feature of this set was that the receiver portion was regenerative rather than the more common super-heterodyne.

The RT-742/ARC-51BX later became the standard UHF set, replacing the AN/ARC-45 and other sets. This 16 watt

transmitter-receiver covers the 225 to 399.95 mHz range in 50 kHz steps plus has 20 preset channels. (An earlier version, the RT-702, operated on .1 mHz steps.) It has a guard receiver for 243.0 mHz and has direction finding capability. The RT-742B also has secure speech capability, which the RT-742 does not have. This set, with the control box and other accessories, weighs 36 pounds and requires 24 volts dc at 15 amps.

The standard set for light aircraft is the AN/ARC-116. This is the UHF companion set to the AN/ARC-115 (mentioned previously) and covers 225 to 399.975 mHz in 25 kHz steps. Like the AN/ARC-51BX, it has a guard receiver for 243.0 mHz and homing capability. It can re-transmit through another AN/ARC-116 or through an AN/ARC-114 or an AN/ARC-115. It is rated at eight watts output and weighs eight pounds.

A pair of ground station amplifiers have come onto the market recently which cover the VHF and UHF aircraft bands. These are the AM-6154/GRT, which covers 118 to 149.95 mHz, and the AM-6155/GRT-22, which covers 225 to 400 mHz. While they were rated to produce 50 watts out with 10 watts of drive, they may be modified to produce 400 to 500 watts extremely easily. The tube used, an 8930 or equivalent, may, with some mechanical changes, be replaced by a 4CX250B which also improves the set. The cost of these amplifiers is in the 40 to 50 cent per watt range, making them a very attractive item.

The other Command set replacement, the RT-427/ARC-39, was a 2 to 9.1 mHz AM transmitter-receiver designed to fit a standard 10-7/8 inch mount. The frequency range was covered in two bands, 2 to 4.5 and 4.5 to 9.1 mHz, with six crystal controlled channels in each band. Two crystals were required for each channel, one each for the transmitter and the receiver. The PA had a 6159 (24 volt version of the 6146) and was rated at 10 watts output. The radio was made with four modules, one each for the transmitter (and receiver local oscillator), the receiver front end, the receiver IF and audio, and the tuning mechanism. The modulator and dynamotor were on the main chassis and the antenna tuner had its own chassis. Even though the set was designed for remote control, there were some operating controls on the front panel. The receiver IF was 750 kHz and was overcoupled for AM operation. The transmitter had a clamp circuit in the PA to protect it in case of loss of drive.

One other HF unit produced for aircraft was the RT-651/ARC-95, which was the military designation for the Sunair TR-22-A. This set operated on 22 crystal channels in the 2 to 18 mHz range, and was rated at 35 watts output. Like the AN/ARC-39, it was an AM only set, however was designed specifically for light to medium aircraft. It operated on 24 volts dc and used a semiconductor high voltage supply rather than a dynamotor as in the AN/ARC-39. Each channel, in addition to requiring two crystals, used plug-in coils and different capacitors to set the frequency. An external antenna tuner was needed to match the unit's 50 ohm output to the antenna.

Around 1948, Collins released a replacement for the AN/ART-13s in civilian service. This replacement was the 18S-4, a 2 to 18 mHz AM and CW transmitter-receiver. (The military designation was the RT-380/AR.) The set operated on 20 crystal controlled channels, with the channels set up in pairs so the difference in the frequencies in a pair was no more than one percent. Two crystals were required for each channel, as with the AN/ARC-39. The set fit into a standard 16-1/2 inch mounting rack. Channel selection was done by a remotely controlled motor driven switch. Except for a meter switch, no panel controls were provided.

The transmitter was an immediate "offspring" of the T-412/ART-13B. It had an 813 in the PA and was rated at 100 watts output into a 50 ohm load. The tuning range was covered by 15 different plug-in coils, which could be used with any channel pair. The output network was tuned using coil taps and capacitor selection, and matched a 50 ohm load. The antenna tuner was a separate unit (which contained components originally designed for the AN/ART-13's output network) which was set up for each channel pair.

Like the transmitter, the receiver covered its tuning range using plug in coil sets for the RF and mixer stages. It was a straight-forward design and had a 455 kHz IF. Overall, the unit had decent selectivity and sensitivity considering its age, application and lack of any special filtering. One unusual feature of the receiver was the use of 24 volts dc for both the filament and B+ voltages.

While the high voltage was normally supplied by an internal dynamotor, some of these sets were made with an internal 115 vac, 400 Hz, 3 phase power supply. This version was designated the 18S-4B.

About ten years later, Collins replaced the 18S-4 with the 618S-1. This was a 2 to 25 mHz AM and CW transceiver which covered the band in 144 crystal controlled channels. Unlike the 18S-4, the 618S-1 used only only crystal per channel and tuned automatically using servo mechanisms. The PA had three 6159s in parallel and was rated at 90 to 100 watts output into a 50 ohm load. The set was built using modules for the oscillator, RF tuner, receive IF and detector, receive audio, BFO and offset oscillator, PA, and the servo amplifiers. The modulator was built into the main chassis. This set also used an external antenna tuner which, like the radio, was automatically tuned. The case size was the same as the 18S-4 and it fit the same type of mount.

The military evaluated this set as a possible replacement for the RCA-designed AN/ARC-21. While a few 618S-1s saw military service, the military version, known as the RT-311/ARC-38, was somewhat different from it. Where the 618S-1 had a single 6 kHz filter in the IF, the RT-311 had two filters, one each 2 and 8.5 kHz wide. The power amplifier was redesigned for faster operation and

less chance of tune-up on a harmonic of the desired channel. Finally, the crystal oscillator was replaced by a VFO system that allowed the set to tune on .5 or 1 kHz steps anywhere in the tuning range.

A quantity of 618S-1s and RT-311s were converted to SSB by RCA. These units were designated the 618S-1/MC and RT-594/ARC-38A respectively. All four versions of the set were identical outwardly, with the only difference being the identifying tag. As long as the proper control box was used, the sets were fully interchangeable.

The R-105/ARR-15 was a Collins designed replacement for the BC-348. This receiver covered 1.5 to 18 mHz in six bands with both continuous tuning and ten auto-tuned presets. The tuning range and presets allowed the set to operate with the AN/ART-13 on a channel by channel basis. This was a single conversion set with a rather unusual IF and BFO system. The IF was tuned across the 450 to 550 kHz range along with the BFO control to allow more accurate tuning. Like the BC-348, the R-105 operated from 28 volts dc and had an internal dynamotor. It fit into a standard 10-7/8 inch mount. The civilian designation for this receiver was the 51H-3.

In the late fifties, the AN/ARR-15 was replaced by the R-648/ARR-41. This set covered 190 to 550 kHz and 2 to 25 mHz in five bands, although the tuning controls were set up for 1 mHz increments. The R-648 was a dual conversion receiver having a 500 kHz final IF and mechanical filters for 4.0 and 1.4 kHz bandwidths. Like its predecessors, the set operated on 28 volts dc and had a built-in dynamotor. While the BC-348 and AN/ARR-15 had been used with the AN/ART-13, the R-648 was used with the later Collins 618S-1 and RT-311/ARC-38.

Conversions for both the R-105 and the R-648 have appeared. None have been complex, covering only powering the sets plus some minor improvements to both. Like many of the receivers available after the war, the only conversion really required was the addition of a power supply.

The Hammerlund Super-Pros continued their military career after the war. Among the last of these to be used was the SP-600-JX, which the military called the R-274A and R-274B. These receivers covered 540 kHz to 54 mHz in six continuously tuneable bands plus on six crystal controlled channels. They were dual conversion sets with a 455 kHz second IF and six selectivity steps, the last three of which were crystal. Unlike the earlier versions, the R-274A and -B had built-in ac power supplies. Like them, these were high quality receivers designed for long term reliability.

A similar receiver, the Hallicrafters SX-73, was designated the R-274 or R-274D. While it was functionally identical, there were differences between the two versions, the most obvious being the lack of a band-spread on the Hallicrafters version. This was still an excellent receiver and a good match for the Super-Pro.

Just after the war, Collins introduced their 51J- series of receivers. These receivers covered 540 kHz to 30 mHz in 30 bands, each (except the first) 1 mHz wide. This was also a dual conversion set, but with a 500 kHz second IF and five selectivity settings. Like the SP-600-JX, it had a built-in ac power supply. The military version was the R-388, which was like the 51J-3 model.

Collins later brought out the R-390 series receivers which covered 540 kHz to 32 mHz in 32 bands. These were triple conversion sets with a 455 kHz final IF. The base model was the R-390. The R-390A was an improved version which had mechanical filters in the IF. The R-391 was like the R-390 except that it eight presettable channels. The R-392 was a light-weight version designed to operate from 24 volts dc and intended for vehicular installations. Except for the R-392, all of the sets had a built-in 115 vac power supply. The sets were, like the R-274 and R-388, designed for AM and CW operation however also operated RTTY with external equipment. They were often found in dual or triple diversity installations.

Very few conversions were written for these receivers. Like the earlier Super-Pros, those done were minor and covered adding product detectors and making small improvements. On the other hand, these receivers are considered by some to be the best ever made that are available and they actually require no conversion to be put into use. While heavy (The R-390 weighs around 95 lbs.) and designed for rack mounting, these are very fine units for amateur and general listening use.

In the late fifties, Collins introduced a replacement for the 51J-series receivers in the form of the 51S-series. Like the 51Js, these were general coverage units having 30 bands and were dual conversion with a 500 kHz second IF. They were, however, much more compact and lighter by about half the weight of the 51J units. Also, they used mechanical filters for USB, LSB and CW reception rather than the crystal filters found in the older receivers.

LTV Corporation converted a number of these units for aircraft use and called them the G-133. This version had extra electronics added to allow external equipment to accurately measure the frequency to which the receiver was tuned. The tuning range was extended down from 500 kHz to 200 kHz, with the lower limit set by the internal filtering. While designed for aircraft use, the receivers retained the ability to operate on 60 Hz power since the supply was rated to operate from 115 or 220 volts, 50 to 400 Hz. (A source of 24 volts dc at about 170 ma was also required for this version for the AM BFO.) The converted package was still about half the size and weight of the 51J-series and performed much better.

The R-174/GRR-5 was brought out in the mid fifties as an HF monitor receiver installed with the various tactical FM sets. This AM and CW receiver covered 1.5 to 18 mHz in four bands, with continuous tuning or ten presets. Power was supplied by the PP-308 power supply which was mounted in the same cabinet and operated on

6, 12 or 24 volts dc, 115 volts ac or from dry cells. While compact (for its day), the receiver was a decent performer.

The only conversion written on this set covered a power supply plus adding an S-meter and some detail work. Another article described it rather glowingly...in 1983.

Collins also designed the T-195/GRC-19 which was a vehicle-mounted transmitter used with the R-392/URR mentioned previously. This transmitter covered 1.5 to 20 mHz in ten bands, either continuously tuned or on eight preset channels, and operated on AM or CW, or on RTTY when the MD-203/GR was used with it. (The CV-278/GR was the companion receiving RTTY converter.) It operated on 28 volts dc (at 42 amps maximum) with two built-in dynamotors, and was rated at 100 watts output from a 4X150D. The tuning control tuned the VFO and multiplier stages while the PA and output network tuning was done by servo motors.

The same basic design was also used by Collins in the T-368/URT, which replaced the BC-610. This unit also covered 1.5 to 20 mHz and operated on AM and CW, with RTTY being an option requiring outside equipment. There were no preset channels on this transmitter, and all the PA and output tuning was manual. The PA used a 4-400 and was rated at 400 watts output. The T-368 was about the same size and weight as the BC-610 and operated from 115 vac.

Both the T-195 and the T-368 (plus their associated receivers) were replaced by the RT-662 and the later RT-834. These units are still in service, although a few are showing up as surplus now and then. Both of these receiver-exciter units cover 2 to 32 mHz, the RT-662 doing so in 1 kHz steps with a plus/minus 500 Hz vernier and the RT-834 doing it in 100 Hz steps. They operate on SSB and CW and use the AM-3394 for 400 watt output. Like the older units, RTTY is also handled using outside equipment. The RT-662 and RT-834 are smaller and lighter than the T-195, making the whole system in which they're installed much more compact.

The BC-1306 was a 3.8 to 6.5 mHz transmitter-receiver that came out during the second World War. It operated on AM and CW and had a 2E22 in the PA for a rated 15 watt output. This set was used as both a manpack set with a hand-crank generator and batteries, and as a mobile unit using a vibrator power supply. After the war, the set was replaced with the RT-77/GRC-9 which was like the BC-1306 but covered 2 to 12 mHz in three bands. Both were continuously tuned plus had crystal channels, the BC-1306 having two and the RT-77 having two per band. A power supply for operation from 115 volts ac was also produced for the RT-77 in addition to the supplies made originally for the BC-1306.

At least two conversions were written for the AN/GRC-9, which made it into a 50 watt 80, 40 and 30 meter cw rig. Both consisted of basically adding a suitable power supply to the set. Since it and the BC-1306 both use suppressor grid modulation, one article suggested that AM not be used with these sets.

The AN/GRC-9 was later replaced by the AN/PRC-74 which is still in service. This set covers 2 to 12 mHz in the earlier models with later models covering 2 to 18 mHz. It is a CW and SSB unit rated at about 15 watts output and operates from a variety of supplies ranging from 10.5 to 31 volts dc or 115/230 volts ac. Like the AN/GRC-9, the AN/PRC-74 is a multi-use radio.

In the early and mid sixties, several other low power HF sets were brought out to fill a variety of requirements. Among these were the AN/GRC-109, the RT-671/PRC-47, the AN/PRC-64 and the RT-654/TRC-77.

The AN/GRC-109 consisted of the T-784 transmitter, the R-1004 receiver and several power supplies for 75 to 260 volt ac, 6 volt dc or dry cell and hand-crank generator operation. The T-784 was a CW only unit, operating on one crystal controlled channel in the 3 to 22 mHz range. It was rated at 15 watts output from a 2E26. The R-1004 was an AM and CW receiver which covered 3 to 24 mHz in three bands plus had one crystal controlled channel. This system was designed for field use where there was space and time to string a wire antenna.

The RT-671/PRC-47 transceiver covered 2 to 12 mHz on 1 kHz steps and operated on CW and SSB. Provision was made on it for RTTY using an external modulator and converter. The set was mostly semiconductor with the only tubes used being in the receiver front end and the transmitter driver and PA. The PA had a PL-177 and was rated at 20 or 100 watts output. The RT-671 was used in mobile and field sites, and required 24 volts dc or 115 volts ac, 400 Hz to operate.

The RT-654/TRC-77 was a 3 to 8 mHz set which operated on six crystal channels. The receiver was an AM and CW unit while the transmitter was CW only. This was a hybrid unit having tubes only in the transmitter's RF stages. The PA was a 2E24 and was rated at 15 watts output. This set was also battery operated, requiring a source of 12 volts dc at 3.75 amps to run.

Several of the sets mentioned plus the RT-841/PRC-77 (to be covered later) were replaced by the AN/PRC-70, which is still in service. This set covers 2 to 76 mHz in 100 Hz increments and is rated at 20 to 30 watts out, dependent on frequency. This set operates on AM, CW, SSB and FM and is used in a variety of installations.

After World War II, there was an increased use of FM in tactical nets. The band was extended to 20 to 55 mHz, and divided into three sections. Armored units were assigned to 20 to 27.9 mHz, artillery units were put on 27 to 38.9 mHz and infantry had 38 to 54.9 mHz. There was also a common band running from 47 to 58.4 mHz plus a .9 mHz overlap between sections to allow units of different types to talk to one another. This "band plan" continued into the sixties. The band was shifted up to 30 to 76 mHz in the mid sixties

and the original radios replaced with newer ones to reflect this.

The RT-66, RT-67 and RT-68 were brought out in the late forties to cover the FM tactical band. The RT-66 covered 20 to 27.9 mHz, the RT-67 covered 27 to 38.9 mHz and the RT-68 covered 38 to 54.9 mHz. These were single band sets which covered their ranges either with continuous tuning or on .1 mHz steps. There were also two presets on each set. The PA had a 2E24 in it and was rated at 2 or 16 watts output, dependent on the power setting. The receivers were dual conversion with a 1.4 mHz second IF. The 6 db bandwidth was 85 kHz and the 60 db bandwidth was 160 kHz, so the receivers were definately broad. These sets operated from external power supplies which could be powered by 6, 12 or 24 volts dc or 115 volts ac, dependent on the supply. While generally used in vehicular installations, there were a few fixed installations as well.

Three receivers were brought out at the same time as the RT-66 through RT-68 which covered the same frequency ranges. These were the R-108 (20 to 27.9 mHz), the R-109 (27 to 38.9 mHz) and the R-110 (38 to 54.9 mHz). These were single band receivers using continuous tuning and having three presets each. The IF was 4.3 mHz and, like the transmitter-receivers, they were broad. Power was supplied either from the same supply as the transmitter-receiver or from one of three plug-in supplies which operated on 6, 12 or 24 volts dc.

For field units and very low powered vehicular installations, the RT-174/PRC-8, RT-175/PRC-9 and RT-176/PRC-10 were used. These were pack sets which tuned the same bands as the RT-66, RT-67 and RT-68 respectively and were rated at about 1 watt output. They also were single band, continuously tuned sets only had no presets. For portable operation, these sets were powered by a built-in battery. For vehicular installations, they were used with the AM-598 audio amplifier which operated from 24 volts dc. Like the larger transmitter-receivers, they had a 1.4 mHz final IF and were very broad.

There were two sets designed to cover the 47 to 58 mHz common range. These were the RT-70/PRC and the RT-196/PRC-6.

The RT-70 covered the 47 to 58.4 mHz range in one continuously tuned band and had two presets. While larger than the pack sets, it was rated at only about 1/2 watt out. It was used with an external battery pack as a field set or with the AM-65 in vehicular installations. (The AM-65 used plug-in power supplies which could operate from 6, 12 or 24 volts dc.)

The RT-196/PRC-6 was a single channel crystal controlled walkie-talkie which operated in the 47 to 55 mHz range. It was rated at only .1 watt output and operated from an internal battery pack. It was designed for use by field units working very close together. (The planning range was about 1 mile.)

While not strictly a tactical communications set, the AN/GRC-10 operated in what later became part of the tactical radio range.

This system was used as a wire-radio link and tuned the 54 to 70.9 mHz range in .1 mHz steps. (A wire-radio link is used to connect parts of a telephone system together where it is impractical to run wire. The AN/TRC-1 performed much the same duties in the 70 to 100 mHz range as did the AN/TRC-8 in the 230 to 250 mHz range.) The AN/GRC-10 was made in three basic units, the R-125 receiver, the T-235 transmitter and the DY-94 dynamotor power supply. The receiver was a dual conversion unit with a 4.3 mHz final IF. The transmitter had a 4X150D in the PA and was rated at 10 or 40 watts output. The power supply was discussed in chapter 3.

One aircraft radio that was designed for use with these sets was the RT-294/ARC-44 transmitter-receiver. This unit covered 24 to 51.9 mHz in .1 mHz steps and was rated at 8 watts output. Like most newer aircraft radios, the ARC-44 was designed for remote control and had no operating controls built in. While a tube set, it was relatively light and compact. A companion receiver, the AN/ARR-46, was used with this set and covered the same range.

The change in the band arrangement in the mid sixties removed the division between armored, artillery and infantry frequencies and put the same kind of radios in all three types of units. This not only reduced supply and inventory problems, but also allowed a tighter coordination between the units due to improved communications capabilities. Many of the radios brought out during the change over years are still in service.

The RT-66, RT-67 and RT-68 were replaced by the RT-246 and RT-524 transmitter-receivers. These sets cover th 30 to 75.95 mHz range in two bands and in 50 kHz steps and are rated at 10 and 35 watts output. The radios are essentially identical, the biggest differences being that the RT-246 has ten presets where the RT-524 has none and the RT-524 has a built-in speaker. These sets are designed to operate with the AS-1729 antenna which is electrically tuneable over the 30 to 76 mHz band. Typical to the newer equipment, these sets are capable of retransmit operation and handling external speech security equipment, ie- speech scramblers. (Retransmit mode is not unlike repeater operation. A pair of transmitter-receivers operating on different frequencies are connected together so that anything received by one set is transmitted by the other.) Also typical of new equipment, the RT-246 and RT-524 operate directly from 24 vol dc and require around 10 amps in high power transmit mode.

The auxiliary receiver designed to operate with the RT-246 and RT-524 is the R-442. It also covers 30 to 75.95 mHz in 50 kHz steps and has no presets. This set is designed to operate with a regular 9 foot whip antenna rather than the tuned antenna required by the transmitter-receivers. The R-442 operates on 24 volts dc at about 3/4 amp.

The original replacement for the AN/PRC-8, -9 and -10 sets was the RT-505/PRC-25 transceiver. This hybrid pack set covered 30 to 75.95 mHz in 50 kHz steps and had two presets. It was rated at 2

watts output from a 2DF4 tube and operated either from a battery pack or, in vehicular installations, from the AM-2060 Amplifier-Power Supply. Rather curiously, while the set used detent tuning, the frequency control was via a VFO and could be made continuously tuneable by defeating the detent mechanism.

While the RT-505 is still in some limited service, it was replaced after only a few years by the RT-841/PRC-77. This set was all semiconductor and was rated at four watts output. Like other newer sets, it tuned 30 to 75.95 mHz in 50 kHz steps and had two presets. It used the same battery pack and other accessories as the PRC-25, and was a direct replacement for that set.

The RT-841, like the RT-505, is still in service but has been replaced in many applications by the AN/PRC-70 (mentioned earlier) and the RT-1406/PRC-117. This is a new set which covers 30 to 79.975 mHz in 25 kHz steps or on eight presets. It operates on 12 volts and is rated at 10 watts output. A microprocessor is used in this radio to control an interesting form of communications security. The radio changes frequency rapidly, making it impossible to jam or monitor. These changes are synchronized between the sets in communication by their microprocessors.

The RT-196/PRC-6 was also replaced by two different sets, the AN/PRC-68, and the AN/PRR-9 and AN/PRT-4 combination.

The AN/PRC-68 is a hand-held set which covers 30 to 79.95 mHz in 50 kHz steps. While smaller and lighter than the RT-196, it is rated at 1 watt versus the older set's 1/10 watt output. Like the AN/PRC-117, the coverage has been stretched upward an extra 4 mHz.

The AN/PRR-9 receiver and AN/PRT-4 transmitter work together as a two piece walkie-talkie. They cover the 47 to 57 mHz range on two crystal controlled channels. Each has a built-in antenna, with the one on the transmitter being collapsible. Each also has provision for attachment to a helmet or belt, although the transmitter is operated as a hand-held unit. The transmitter is rated at 450 mw on one channel and 50 to 250 mw on the other. Together, the units and their batteries weigh under two pounds, which is a vast improvement over the RT-196's 13 pounds.

The AN/ARC-44 was replaced by the RT-348/ARC-54 in the mid sixties. This set covered the range of 30 to 69.95 mHz in 50 kHz steps or on 20 preset channels. The ARC-54 was a hybrid set and was rated at 10 watts output. Like the ARC-44, it had a support receiver, that being the AN/ARR-49, which was a semiconductor version of the ARR-46.

The AN/ARC-114 is the third of a set of three radios designed for panel mounting in light aircraft and helicopters. (The other two, the AN/ARC-115 and the AN/ARC-116, have been covered previously.) It covers th 30 to 75.95 mHz band in 50 kHz steps and has a guard receiver for 40.50 mHz. This seven pound package is rated at 10 watts output.

The RT-823/ARC-131, which replaced the AN/ARC-54, is a heavier set at 27 pounds. Like the AN/ARC-114, it covers the 30 to 75.95 mHz range in 50 kHz steps and is rated at 10 watts output. This is a remote controlled set, like the AN/ARC-54, and operates directly from 24 volts dc.

One set of non-tactical radios that has been around for a while is the Motorola designed AN/VRC-19. This was a 152 to 174 mHz set used by such groups as the Military Police and other non-combatant organizations. The transmitter was the T-278 and was rated at 30 watts output. The receiver was the R-394. The transmitter operated on two crystal controlled channels while the receiver operated on one. In addition, there were also 25 to 50 mHz versions of the equipment (the T-208 and R-257) plus high power transmitters (the T-416 and T-417, rated at 50 watts) and base station amplifiers (the AM-494 and AM-495 rated, at 325 watts). The R-394 was also mounted in its own case and called the AN/FRR-36. Power for the transmitters came from external dynamotor supplies which operated from 6, 12 or 24 volts dc plus one 115 volt ac supply. Receiver power came from plug-in supplies which operated from the same voltages.

Several conversions have appeared on the T-278 to put it on 2 meters plus one conversion on the AM-494.

Many of the sets mentioned in this chapter are currently available or are becoming available as surplus. A few appear at hamfests in a variety of conditions and price ranges. All are, as far as quality is concerned, a step above those released after the war and, while conversion may take more effort, are well worth the effort.

This just scratches the surface of the post-war surplus. Availability is variable as some of the sets are released in small batches while others show up in comparitively large quantities. Hamfest availability is also variable, although as a general rule, this trails the market by a few years. There is no foolproof way of knowing what's going to show up when or where, or at what price range. It pays, therefore, to keep ones eyes open when looking for a particular set.

Chapter 6

Non-Communications Electronics

Electronic surplus includes more than just communications radios. There have been numerous navigation, jamming and radar sets, UHF and microwave radio-telephone links, and various control and/or sensing devices. As the needs of the military grow more sophisticated and as technological advances allow these needs to be met with newer devices, the level of sophistication in the surplus also grows. It's an upward spiral and, in the end, the amateurs and experimenters reap the benefits.

While the list of equipment that has become available is fairly long, only a few devices have enjoyed any popularity with amateurs. The others were too costly to convert, too rare to gain wide spread acknowledgement or had no direct application for which they could be converted. A few of the sets that did catch on are described in the following paragraphs.

When the United States first placed a satellite in orbit, a number of SWLs and experimenters scrambled to find a receiver that could hear it. For a while, the BC-733 localizer receiver enjoyed some popularity for this. This unit operated in the 108 to 110 mHz range on six crystal controlled channels and was designed to help keep pilots lined up on a runway during instrument landings. It was about the size of a Command receiver and, while it had only one RF stage, it was fine for this application. The conversion to a satellite receiver consisted mostly of just plugging in a crystal for the proper frequency. This was later followed by conversions to 6 and 2 meters, complete with tuneable local oscillators. The sensitivity wasn't great, but was fine for local work. With the filters needed for the instrument landing equipment removed, there was room inside the set for such things as an added RF stage which helped considerably.

During the war, the Navy used a rather unique way of getting carrier based aircraft back home. It was a direction finding system, like the low frequency beacons used on land. To avoid enemy detection, however, the signal, which was in the 540 to 830 kHz range, was used to modulate a UHF transmitter operating in the 234 to 258 mHz range. This frequency range was above the capabilities of the enemy detection gear, but, after demodulation, the signal worked just like a low frequency beacon.

The R-1/ARR-1 was developed to detect the UHF signal. This was

a TRF receiver which designed to operate with the RU and later ARB type receivers. (It's interesting to note that the RUs were themselves TRF receivers and were the predecessors to the Command sets.) The R-1 detected the UHF signal and fed its output, which was the MF signal to the RU or ARB receiver, which treated it like a regular beacon signal. The R-1 used four 954 acorn tubes and, like the RU, could operate from either 12 or 24 volts. It derived its high voltage from the MF receiver's dynamotor.

When the Command receivers came into use, the R-1 was replaced by the R-4/ARR-2 and its rare 12 volt counterpart, the R-3/ARR-2X. (As a note, the 'X' suffix denoted 12 volt equipment in the older AN-type designation system.) These were a later design and included both the UHF and MF detection functions in one box. Also, the MF range was extended up to 1500 kHz in these sets. They were designed to fit the Command set racks and shared some of the accessories for these radios.

When the R-1 and R-4 became surplus, they gained some popularity as the basis for 1-1/4 meter converters. More recently, however, the R-1 and the front end for the R-4 were converted to 1-1/4 meter preamps for external converters and receivers which took better advantage of the sets characteristics.

The 3/4 meter band received quite a bit of attention after the war due, in part, to three radar sets. These were the BC-788, the RT-7/APN-1 and the RT-34/APS-13. The first two were radar altimeters while the third was used to detect enemy aircraft on the tail of bombers. The BC-788 and the RT-34 were pulse type units rated at about 50 watts peak pulse output while the RT-7 was an FM doppler set rated at 1/10 watt output. All of these sets operated on the 3/4 meter band and the RT-7 was still in limited service into the sixties.

Conversions for these sets consisted mostly of removing the radar related circuits and installing an AM or ATV modulator and detector plus adding a power supply. The RT-34 was among the first sets used for ATV on 3/4 meters, incidently.

Another device used in aircraft is the IFF (Identification Friend or Foe) transponder. In its simplest form, this unit detects a coded signal from a ground station and sends out a coded signal in response. This interrogation and reply (as the two transmissions are called) helps identify friendly aircraft on a radar screen and is still in use today. The units used now are significantly more sophisticated and can give more information, such as the aircraft's altitude, but they still operate on the same basic principal.

Several of these units have come up as surplus and been put into amateur service. The Navy BN and BP, which operated in the 157 to 187 mHz range, were converted to 2 meters. The BC-645 (also known to the Navy as the ABA-1) covered 460 to 490 mHz and was one of the earliest units put on 3/4 meters. (Rather interestingly, these were never used by the military. They were ordered and built

but, due to some SNAFU, the corresponding ground units were never put into operation. As a result, these units were sold complete and totally unused at very low prices.) The last of the transponders to be mentioned is the RT-82/APX-6. This unit operated originally in the 950 to 1150 mHz range and was, for a long time, the most popular set in use on the 25 cm band.

Conversions for these sets were much like those for the 3/4 meter radar sets - the pulse handling equipment was removed and the equipment for amateur use was installed. The BN and BP could already operate from 60 Hz power, however the others required some sort of power supply. No serious or unexpected problems were presented by these sets and at least the RT-82 enjoyed some popularity through the sixties.

Other specialized radio or radio related units have shown up from time to time and, like those discussed in the previous paragraphs, has been or can be very useful to the amateur and experimenter. Prices and availability are both broadly variable. Units like these should not be rejected as possible subjects for conversion just due to their non-communications mode of operation.

Collectively, some of the best bargains in military surplus are in test equipment. Some special purpose equipment has been produced, however the majority of the pieces available are conventional units and often are civilian equipment with military tags on it. Even the special purpose equipment is adaptable in many cases for amateur and other applications.

Generally speaking, test sets require little, if any, conversion for use. Those that do need work, usually only require a power supply. The remainder are specialized units like the TS-170/ARN-5 test oscillator, which may become useful test units fairly easily. Some semiconductor equipment has hit the market as has a faint trickle of digital equipment. As time goes on, the quantities of these two groups will increase. The equipment that is available, however, is still top quality gear and well worth the price.

VOMs and VTVMs are the standard tools of the electronics technician. Indeed, working without one or the other is virtually impossible. While not much variety exists in VOMs, there is quite a range of different VTVMs although the basic instruments are much the same since they operate on the same principal. Ideally, at least one of each should be employed on the workbench to handle the variety of testing and trouble-shooting situations encountered.

The standard VOM was the ME-9/U, also known as the TS-352. This unit covered 2.5 to 1000 volts in six ranges, 250 ua to 10a in eight ranges and resistance x1 to x10k in five ranges. The voltage ranges were for both ac and dc with sensitivities of 20k ohms/volt for dc and 1k ohm/volt for both dc and ac. There was also a built-in adaptor for 5000 volts dc, also with a sensitivity of 20k ohms/volt.The unit was housed in a very rugged and heavy case, quite

able to withstand a lot of abuse.

A later and lighter version of the ME-9 was the AN/PSM-6. This unit had the .5 volt and 100ua ranges added but the 10a and 5000 volt ranges required external adaptors. The revised scales made the unit more useful for semiconductor work and the lighter and smaller package made it more practical for field use.

A variety of VTVMs is available, ranging from the very basic units having limited scales and frequency response to those having multiple functions and a wide frequency range. This variety allows one to pick and choose somewhat, although extra capabilities never hurt. Prices generally vary with capabilities and extra features.

At the low end of the scale, the ME-6/U is probably the most basic unit to become available. It covered .005 to 500 volts rms in six ranges and had an upper frequency limit of 250 kHz. It also had a built-in amplifier with a maximum voltage gain of 4500. This was a handy unit for audio and low frequency RF work, but its limitations cramped its usefullness.

At the other end of the scale, the ME-180/USM-116 was among the most versatile of the military VTVMs. It was essentially an HP 410B with added current scales. The voltage ranges covered 1 to 300 volts ac in six ranges and 1 to 1000 volts dc in seven ranges. It covered resistance ranges of x1 ohm to x1 megohm and current scales of 20ua to 1a. The frequency response using the ac probe was 100 mHz but jumped to 700 mHz when the T-connector was used. There have been few VTVMs with this wide a range of capabilities made before or since the ME-180.

Like VTVMs, oscilloscopes come in a wide variety of flavors, from the very simple to the very versatile. With the military models, a large number of Tektronix scopes and plug-ins, plus a lesser number of other civilian units have appeared. These are the older model scopes and are contemporaries of the military models available. (Some of the scopes are available in both civilian and military versions, the differences being mostly in the identification tag!) Semiconductor units are beginning to show up at reasonable prices. Some of the current offerings are listed in the next few paragraphs.

The TS-34/AP was a small scope designed for testing aircraft radar units. It had a frequency response of 1 mHz and a maximum sweep rate of 10 kHz. It was a small scope and was reasonably portable. The CRT was a 2AP1, which was mounted in a viewing hood to improve the visibility.

The OS-8/U was a later unit use by the military for general radio maintenance. While it was about the same size as the TS-34, it weighed about half as much. The frequency response was better, being 2 mHz vertically and 500 kHz horizontally. It used a 3 inch CRT, however, like the TS-34, didn't have any of the fancy options that the more sophisticated units had.

The OS-106/USM-117 was about the same size as the OS-8 and was a bit heavier. It was a later semiconductor unit with a frequency response limit of about 5 mHz. It used plug-in amplifiers, on of which (the MX-2995) was a dual trace adaptor. The sweep range was .1 usec/cm to .1 sec/cm in 19 steps. Vertical sensitivity ran from .01 volts/division to 25 volts/division. Like the OS-8, it was a general purpose scope, only a little more recent and "fancier".

The last scope to be covered is the AN/USM-140C. This was a 30 mHz scope and used plug-in amplifiers for both the vertical and horizontal circuits. It was much like the Hewlett-Packard 170A. This was a very versatile instrument and, with its 5 inch CRT, an excellent one for a wide range of testing needs.

Numerous other scopes, both military and civilian, have become surplus and are currently available. Like VOMs and VTVMs, these are basic tools for the workbench. The range of instruments available allows one to pick one that fits one's needs and/or pocketbook.

The last test unit to be mentioned is the heterodyne frequency meter. These have been available since the war and were, for a long time, popular with amateurs. Recently, however, they have been all but replaced by digital instruments which are more precise but less versatile. Since the precision offered by the newer instruments is often not necessary, the older units still have quite a bit to offer.

A heterodyne frequency meter consists basically of three sections. These are a VFO, a mixer and an audio amplifier. A signal, such as that from a transmitter, is fed to the mixed where it's combined with that from the VFO. The difference is then fed to the audio amplifier whose output is connected to an indicator of some type, usually a set of headphones. The VFO is tuned until its signal (or a harmonic) zero-beats the incoming signal. The tuning dial is then read and the frequency determined from it, via a calibration book in most cases. The oscillator may also be tuned to a given frequency and, since the signal is fairly strong, used as a signal generator. For this application, the audio amplifier becomes an audio oscillator and is used to modulate the VFO. They also have a crystal calibrator to insure calibration accuracy. Power may be from an ac supply or dry batteries, dependent on the model and, in a few cases, which supply is installed.

The most popular of the heterodyne frequency meters was the BC-221 and its Navy counterpart, the LM. They both appeared just after the end of the war and are still available today. The BC-221 covered 125 kHz to 20 mHz in two bands and had a rated accuracy of better than .02%. Like most of the early units, it had an indirectly calibrated dial. That is, the dial reading had to be looked up in a calibration book to get the actual frequency. It was designed to be operated from batteries, although an ac power supply was made for it which fit into the battery compartment. Only the later models of the BC-221 had modulation, although the earlier ones were often

converted to include it. The LM was much like the BC-221 except that the power supply was external, all models had modulation and the early models only went down to 175 kHz. A few battery operated models of the LM were made, however most operated from the ac line.

The TS-173, -174, -175 and -323 were VHF versions of the BC-221. These units covered 90 to 450 mHz, 20 to 250 mHz, 85 to 1000 mHz and 20 to 480 mHz respectively. Like the BC-221, they operated from batteries of an ac power supply mounted in the battery compartment, and had a rated accuracy of better than .02%. (The TS-323 was rated at .005%.) As with the LMs and late BC-221s, they had modulation capability and used a 400 Hz note.

The 100 mHz to 10 gHz range was covered by the TS-186/UP. This was an ac operated device with a rated accuracy of better than .01%. Unlike the previously mentioned units, it used a meter for a zero-beat indicator rather than headphones. While larger than the other instruments, it was still portable and was used for radar testing.

A trio of later heterodyne frequency meters covered the 100 kHz to 500 mHz range, these being the FR-4, -5 and -6/U. They covered 100 kHz to 20 mHz, 10 to 100 mHz and 100 to 500 mHz respectively with a rated accuracy of better than .001% and, like earlier units, had indirectly read dials. They used multiple oscillators to improve accuracy and remove unwanted harmonics. They were larger than the other instruments and were designed for rack mounting. They operated from 115 or 230 volts ac at 60 Hz.

The AN/URM-32 was a portable instrument which covered 125 kHz to 1000 mHz in three bands and replaced all the earlier portables. Two separate oscillators were used, one for the lower two bands and one for the top band. It had a rated accuracy of better than .01% and had an indirectly read dial. Like the early units, it operated from either batteries or an ac supply mounted in the battery compartment. It was an improvement over the older units not only due to the improved accuracy, but also due to having only one instrument do the work of several.

The last unit to be mentioned is the FR-149/USM-159. This was essentially a semiconductor version of the AN/URM-32, however it had a directly calibrated dial. (A calibration book was included, but was only used to find the harmonics of the indicated frequency, thus saving multiplication errors.) It operated from six 'D' cells or a built-in ac power supply and had all the features of the older units.

Other standard instruments, including a large variety of signal and sweep generators, are available as surplus. Practically any need for test gear may be filled with these rugged, dependable units. All of the units mentioned are, or have recently been, available as surplus as are many others, including a variety of speciallized units. The prices accurately reflect their general usefulness.

One of the more unique and potentially useful devices to appear is the AN/ARA-19 remote tuning system. Consisting of three major components - the AM-203 oscillator/amplifier, the PD-5 tuning drive, and the C-423 control box - it was used to tune the AN/ARN-6 and -7 radio compass receivers.

The older radio compass receivers were heavy and somewhat large. They were mounted in out of the way places which meant they weren't always easily accessed with mechanical tuning drives. Further, more often than not, there were two control boxes (one each for the pilot and the navigator) which placed a lot of drag on the tuning system. The overall result was a system which was difficult at best to manage. Other radios didn't usually have this problem since, in most cases, there was only one tuning control box.

The AN/ARA-19 tuning system replaced mechanical tuning cables with electrical ones. While only one box could be in control at any given time, any number of control boxes could be attached to the system. Activating a control box was simply a matter of switching it into the system. Further, performance was unaffected by variations (within limits) in line voltage, noise and cable length. Finally, it ran entirely from 24 volts dc, hence required no supply beyond the aircraft's battery.

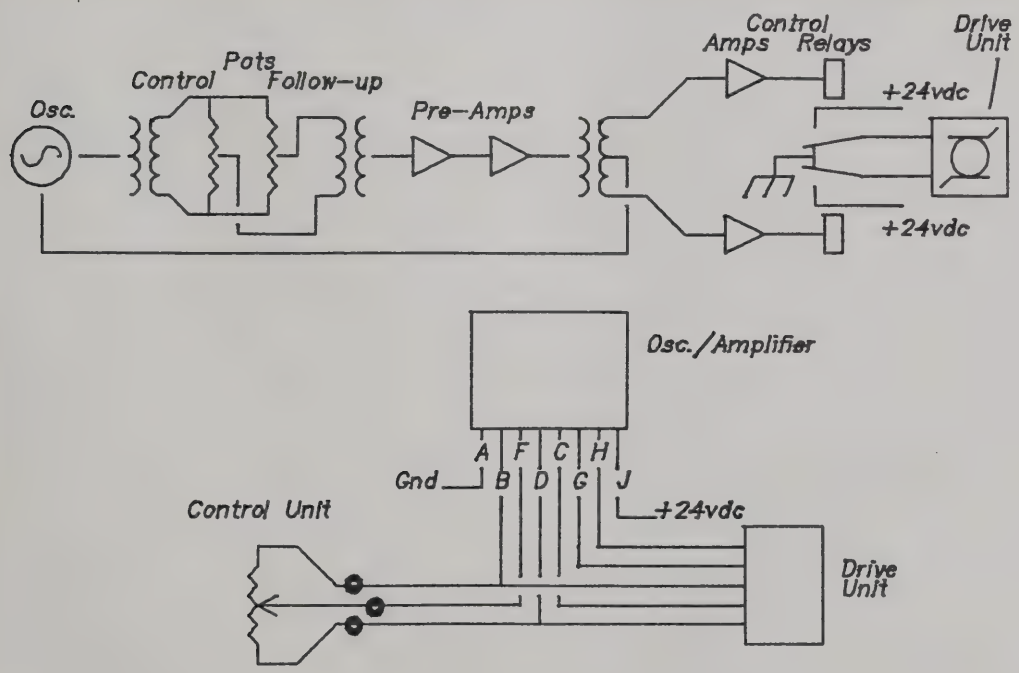


Fig 6-1 AN/ARA-19 Control System

The method of operation was actually quite simple. (Refer, please, to figure 6-1.) The oscillator signal from the AM-203 was applied across both the control box potentiometer and the follow-up potentiometer in the tuning drive. These pots formed a bridge, the output of which was taken from the taps and fed to the input of the signal amplifier. As long as both pots were in the same position, the bridge was balanced and there was no output. When the control pot was rotated, the bridge was unbalanced, and a signal was fed to the amplifier. The phase of the signal indicated the direction it was rotated and the level indicated how far it was rotated relative to the follow-up pot. The output of the signal amplifier was transformer coupled to the input of the control amplifier. Part of the oscillator signal was fed to the center tap on the transformer's secondary as a reference signal. The control signal was in phase with the reference on one side of the transformer and out of phase on the other. The in-phase side control amplifier was turned on, which operated one of the control relays to start the motor. The motor ran until the bridge was balanced again, hence there was no error signal and everything shut off again.

Since the system doesn't really care what's attached to it as long as it has its control signals, the drive may be used to turn any light duty device requiring rotary motion. Therefore, it may be used to tune other radios or antenna tuners, rotate small loops or other light antennas, etc. As is, the drive runs about 22 turns, stop to stop. As long as the proper follow-up is provided, a heavier drive (including ac motors) may be substituted for the PD-5, thus allowing larger equipment to be operated.

A group of devices often ignored by amateurs, experimenters, et al, is the 400 Hz rotating machinery such as selsyns, servoes and motors. There are two basic problems involved. The first is a general lack of understanding of these devices. The second is the association of operating 400 Hz devices on 60 Hz with the generation of lots of smoke. While there is a lack of accuracy in doing so, these units may be operated on 60 Hz without trouble and with results adequate for amateur (et al) requirements.

A selsyn (also called an "autosyn" or "synchro") is basically a transformer with one primary and three secondaries. The secondaries, called "stators", are mounted 120 degrees apart around the primary and are connected at one end. The primary, called a "rotor", is mounted on a shaft and is free to rotate. Voltage is applied to the rotor and is induced into the stators. When the rotor is turned, the induced voltage and phase is changed in the stators.

When two selsyns are connected together and voltage is applied to both rotors, they will rotate until the voltages in both sets of stators is identical, at which point they will stop. If one rotor is moved, the stator voltages will change causing current to flow again. The other rotor will turn in response until the circuit is balanced again and there is no current flow.

There are three basic types of selsyns, these being transmitters, receivers (or "resolvers") and differentials. These all fall into one of two catagories, which are torque devices and control devices. Torque devices are for light-duty applications, such as position indicators. Control devices are used to provide error signals for servo systems controlling heavier devices such as gun turrets.

Transmitters are used to provide a position signal and are rotated either manually or by some other device. Torque transmitters may be used as control transmitters, but the reverse is not true. Although there is a reduction in accuracy, several receiving devices may be attached to a torque transmitter.

Receivers are used to indicate an angular position, based on the signals on the stators. This position information may be presented directly, as with a radio compass indicator, or as input to another device. Receivers as such are found only in torque systems. Control transformers are a special kind of receiver which provide the error signals used in a servo system. They are not interchangeable with torque receivers.

A differential is a unique device having not only three stator windings, but three rotor windings as well. There are two kinds of differentials, transmitting and receiving. Transmitting differentials are used to modify the information from a transmitter, such as in a compensating control. A receiving differential accepts the signals from two transmitters, one to the stator and one to the rotor. The difference between them moves the rotor in proportion to the that difference. Both transmitting and receiving differentials are used in torque systems, however only transmitting differentials are used in control systems. Only the torque units are interchangeable.

Some selsyns have four stator and three rotor leads. On these, the common stator lead is available and the rotor is center-tapped. (These are called "two-phase" rotors.) Except for the extra wires, these are the same as the five-wire devices.

The basic hook-up for selsyns is fairly simple. The stator connections are connected together, S1 to S1, S2 to S2 and S3 to S3. Power is applied to the rotors which, for 26 volt, 400 Hz units, should be around 12 volts at 60 Hz. To save wiring between the units, one of the stator connections may be wired to one of the rotor leads so that only four wires are going between the units. Seven wire selsyns are wired much the same except that up to 24 volts ac may be applied since these are usually 57.5 volt devices when operated on 400 Hz.

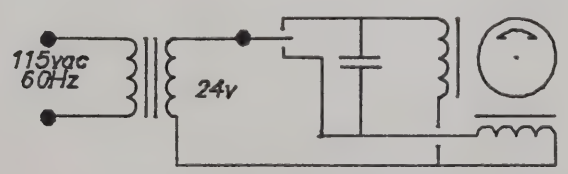
Several articles have been written on using selsyns for antenna position indicators. Other uses for them include tuning aids, wind direction indicators, drive controls, and any other application where very light rotary motion is needed.

Like selsyns, servo motors are commonly found surplus items. They are two phase ac motors controllable in both direction and speed of rotation. The most commonly found ones operate from 115 volts ac at 400 Hz. They will operate, albeit slowly, on 24 volts ac at 60 Hz, with bursts of higher voltage where the extra power is needed. (These bursts must be kept short to keep from burning the motor up.) To use them, all that's necessary is to put a capacitor in series with one of the windings to provide a phase shift. The value will vary, dependent on motor characteristics and load, however the value shown in figure 6-2 will be a good starting point. The capacitor should be a non-polarized unit with a voltage rating high enough to handle any voltage bursts that may be applied. Note that this circuit is not unlike that for a number of antenna rotors.

Servo motors are useful for a number of applications. Several sets, such as the Collins 618S-1, the AN/ARC-38, the Collins 180L-series and CU-991 antenna couplers, use them for auto-tuning. By rewiring them so the signals from the tuning sensors go to meters rather than the servo amplifiers, and operating the motors with manual switches, a "quick and dirty" way of using these units is achieved. A few articles on auto-tuning systems for antennas and amplifiers have appeared in both 'QST' and '73' magazines. These systems may be adapted to control servo motors to do the same thing.

Some of the radio compass loop antennas are turned by servo motors. The scheme used in figure 6-2 may be used to turn these as well. These loops also have selsyns built in for direction information making them useful for direction finding, nulling out interference, etc.

Other uses, such as motor-driven potentiometers, rotors for small antennas, and remote actuators, are possible. Like selsyns, the uses are limited only by one's imagination.



Cap: 8uF, 50v non-polarized

Fig 6-2 Basic Servo Motor Control System

During and since the war, the services have used a large variety of headsets, handsets and microphones. Many of these are available today and some are still available in new condition. Typically, the microphones are 40 to 100 ohm carbon units and the headsets are 600 ohm magnetic ones. Handsets usually have 50 ohm carbon microphones and 300 ohm receivers. Some variations exist in both the type and impedance of all of these devices. A representative sample of these devices plus some accessories is shown in the following pages.

Non-communications electronics can provide quite an education unto themselves. Even if the pieces are never used for any practical application, their usefulness as a learning tool makes them quite a good investment. Those that do have an immediate application (such as headphones) are an economical alternative to commercially available equipment and are of at least equal, if not higher, quality.

H-33/PT	U-77 Connector, Push-to-talk
H-102	Telephone Handset, Built-in Ringer, Requires 3 & 6 volts dc
H-108/U	Handset/headset
H-138/GR	U-229 Connector, Push-to-talk, Belt clip, Mic. is squared off.
H-165/U	Push-to-talk, Coiled cord
H-189/GR	Like H-138/GR but has round mic.
H-250/U	Light-weight version of H-189/GR
TS-9	250 ohm receiver, Butterfly Push-to-talk
TS-11	3500 ohm receiver, Push-to-talk
TS-13	As TS-11 but with Butterfly Push-to-talk (Note:H-22, -23 are the same basic handset)

Military Handsets

M-29	40-100 ohm, U-77 Connector
M-32/AIC	40-50 ohm, Used with oxygen masks
M-33/AIC	40-50 ohm, Boom mic.
M-34/AIC	40-50 ohm, Hand-held
M-52/U	40-100 ohms
M-80/U	Dynamic, Noise-cancelling, U-299 Connector
M-86/U	50 ohm Dynamic, Level Control
RS-38	100 ohm, Hand-held
T-17	60 ohm, With handle
T-24	60 ohm
T-26	40-50 ohm, On chest plate
T-30	120 ohm, Two-button throat mic.
T-32	40-50 ohm, On desk stand
T-45	60 ohm, Noise cancelling, Lip mic.
T-56	Sound-powered, Intruder detector, On 6 inch spike

Military Microphones

H-62	Rubber cushions, clip for lip mic.
H-63	As H-62, but has 100 ohm boom mic.
H-70	Rubber cushions
H-71	For use in flight helmets
H-75	For use in crash helmets
H-81	300 ohm, Single element, 40 ohm boom mic., U-77 connector
H-101/U	Has boom mic.,U-229 connector
H-113	Rubber cushions
H-140/GR	500 ohm, U-182 connector
H-144	As H-81
H-161/U	Has boom mi. and chest switch
H-230	500 ohm, Like HS-30 but with velour cushions added
H-380	Has 100 ihm boom mic.,U-77 connector
HS-16	520 ohm, Pin plugs
HS-17	300 ohm, Has 50 ohm mic. on chest plate
HS-20	470 ohm, Single element, Spade lugs
HS-22	8000 ohm elements, Cushions
HS-23	Like HS-22
HS-30	500 ohm, M-300 ear inserts
HS-33	Rubber cushions
HS-88	For use in flight helmets
HS-140/U	U-229 connector
HS-251/U	As HS-140/U

Military Headsets

CD-307	Extension Cord, 5 foot, Has JK-26 and PL-55
CD-318	Extension Cord, 7 foot, Has PL-68 and Push-to-Talk, Used with T-30 mic.
CD-494	Y-cord for handsets, Has PL-55 and PL-68
CD-604	Transformer cord, 500 ohm to 4000 ohm, Has PL-54 on 6 inch cord, Used with HS-30
CD-605	As CD-604 except with PL-55 on 30 inch cord
CO-78	Y-cord for handsets, 7 foot, No connectors
CX-1422/U	Y-cord for handsets, 10 foot-10 inch, Has PL-55 and PL-68
HB-1	Headband, Used with HS-16 and similar sized elements
HB-2, -7	Headband, Used with HS-23, HS-33 and similar sized elements
M-300	Rubber ear inserts, Used with HS-30 and HS-230
MX-41	2-3/4 inch rubber earphone cushions
MX-162	2-1/2 inch rubber earphone cushions
MX-301	4 inch chamois earphone cushions
SA-142B/GSA-6	Hand switch, Has momentary and locking 'Radio' switch

Military Audio Accessories

Chapter 7

Published Conversions

Quite a collection of conversions has been published since the war. Some of these were very basic while others were quite extensive and/or complex. Still others used components from surplus sets in new designs. All had something useful in them, whether or not one may be working on the particular set being discussed. In the mid-sixties, '73' magazine compiled a list of all the conversions done to that time and published it under the title of *Guide to Surplus*. Also, 'CQ' magazine collected a number of their articles and printed two books, *Command Sets* and *Surplus Conversion Guide* (which included *Command Sets* as part of it.) Other books were printed during the post-war decade or so, but all are now long out of print.

In 1982, Tab Books (Blue Ridge Summit, PA, 17214) printed a book by Starin called *How to Buy and Convert Surplus Electronic Equipment*. (It's Tab book number 1388.) While the conversions themselves are minimal, the book does contain some good information on surplus in general, plus fairly extensive theory of operation and trouble shooting information on the AN/FRR-36, AN/GRC-9, AN/PRC-6, RT-66, -67, -68 and -70, and the AN/TRC-77. It also covers in the same way, the older Motorola H and P series sets and the RF Communications Co-Pilot.

The following lists are of some of the older books and articles. They are by no means complete, however are representative of what has been done. The first group is of the units covered by the older books. The second group is a list of the magazine articles with a brief note on what is covered in each. Both are organized into five sections, one each for Signal Corps, Navy, JAN (JETDS), Miscellaneous and Command sets. A third group of lists is also presented which is of the magazines containing conversions. This is a helpful cross reference when one is buying (or otherwise acquiring) magazines from a collection.

The books and magazines listed may sometimes found at hamfests, used book stores, libraries, and in the collections of amateurs. The magazines often show at hamfests for a few dollars for an entire year's worth. Also, some of them may be available from the publishers as back issues.

Conversion Books

Surplus Conversions by Editors & Engineers

Volume I

BC-221	BC-645	Command Sets
BC-312, -342	BC-1068	TBY
BC-348	PE-103	VT-tube Cross-Index
BC-412	SCR-522	

Volume II

BC-375	LM	Command Sets
BC-1206	AM-26/AIC	Bendix TA-12
ARB (Schematic)	RT-34/APS-13	RCA ATV-112
GO-9 (TBW)	T-47/ART-13	Surplus Drives as Beam Rotors

Volume III

BC-191, -375	SCR-522	RT-19/ARC-4
BC-312, -342	ASB-5 (Schematic)	R-4/ARR-2 (Schematic)
BC-348	LM	T-47/ART-13
BC-603	MBF	AN/CRC-7
BC-659 (Schematic)	AN/APA-10 (Schem)	RT-159/URC-4
BC-1066	RT-7/APN-1	Command Sets
BC-1253	R-9/APN-4	FT-241 Crystals in Lattice Filters
BC-1335	AN/APT-2 (Schem)	
RM-52, -53	AN/APT-5 (Schem)	WE-701 Tube

Surplus Handbook by Editors & Engineers

Volume I, Receiver and Receiver/Transmitter Schematics

BC-222	BC-779	RAX
BC-AR-231	BC-794	TBY
BC-312, -342	BC-923	TCS (Rec Only)
BC-348	BC-1000	RT-7/APN-1
BC-603, -683	BC-1004	RT-34/APS-13
BC-611	BC-1066	RT-19/ARC-4
BC-624	BC-1206	AN/ARC-5 (HF & VHF Recs Only)
BC-654	BC-1306	
BC-659	ARB	R-4/ARR-2
BC-669	ASB-7	AN/CRC-7
BC-728	DAK	No. 19, Mk II
BC-745	GF-11	MN-26
BC-764	RAK-5	Super-Pro
	RAL-5	VT-Tube Cross Index

Surplus Conversion Handbook by 'CQ' magazine

BC-191, -375	BC-624, -625	RT-18/ARC-1
BC-224	BC-659	AN/ARC-3
BC-312, -342	BC-669	RT-19/ARC-4
BC-348	BC-779	T-47/ART-13
BC-603, -683	BC-794	Command Sets
BC-604, -684	BC-1004	Super-Pro
BC-620	BC-1068	FT-241 Crystal List

Surplus Schematics Handbook by 'CQ' Magazine

BC-189	SCR-522	AN/APA-38
BC-191, -375	TG-34	RT-7/APN-1
BC-AR-231	ARB	AN/APR-1 (AN/SPR-1)
BC-312, -342	ASB	AN/APR-2 (AN/SPR-2)
BC-348	ATJ, ATK Camera	RT-34/APS-13
BC-438	BN, BP	RT-18/ARC-1
BC-474	DAE	AN/ARC-3
BC-603, -683	GF-11	RT-19/ARC-4
BC-610	GO-9 (TBW)	R-5/ARN-7
BC-611	LM	R-4/ARR-2
BC-620, -659	RAK	T-47/ART-13
BC-640	RAL	AN/CRC-7
BC-645	RAO-7	T-74/CRT-3
BC-652, -653	RAS	RT-66, -67, -68/GR
BC-684	RAX	R-174/GRR-5
BC-728	RBH	RT-196/PRC-6
BC-733	RBL	AS-81/GR
BC-745	RBM	AN/PRS-3
BC-779, -794, -1004	RBS	TS-251/UP
BC-906	RDC	HF Command Sets
BC-969	RDR	VHF Command Trans.
BC-1000	RDZ	No. 19, MK II
BC-1023	RU-16	JT-350
BC-1206	TBS (Rec Only)	MN-26
BC-1335	TBX	Wilcox F-3
I-122	TBY	No. 208 O'scope
I-177	TCK	
I-208	TCS	
RC-56, -57	TS-34/AP	

Conversion Diagrams by R & M Radio Co.

BC-221 (Schem)	SCR-522 (Conv)	R-7/APN-4 (Schem)
BC-348 (Conv)	SCR-718 (Schem)	T-47/ART-13 (Schem)
BC-375 (Conv)	RT-7/APN-1 (Schem)	Command Recs (Conv)

NOMENCLATURE	TITLE	DATE	COMMENTS
BC-191, -375	E&E Vol I, III		
	CQ Sur Conv HB		
	R&M		
	CQ	5/49	Conversion with 826 in PA
		2/50	Components in Antenna Tuner
		12/54	TU as Exciter Foundation
		9/55	Components in Transmitter
		5/57	Components in Mobile Trans
		1/59	Components in 900 w Linear
		7/59	Tap Switch as Antenna Sw
		5/60	Parts in 80-20 m CW Trans
		5/61	Components in 400 w Linear
	QST	12/46	Conversion Information
		7/47	TU Components in VFO
		9/48	TU Components in Tx (Pt 1)
		10/48	TU components in Tx (Pt 2)
		8/49	<H&K> Tap Switch as Ant Sw
		10/49	<H&K> Using Caps in VFO
		10/50	Enclosure for VHF Freq Meter
		9/51	<H&K> Identifying TU Caps
		6/54	Components in 813 Trans
	Radio Elect	11/48	TU-10 as 10 meter Amp.
		6/49	Parts in 80-20 m Trans
	Radio News	9/47	TU-5 Parts in 80 meter VFO
		11/47	TU-6 Case for Trans-Rec
	Radio/TV News	12/48	TU-6 Components in VFO
BC-221	E&E Vol I		
	73	9/66	Use on VHF
	CQ	4/47	Power Supply
		1/48	General Information
		10/48	Null Indicator
		8/49	Adding Modulation
		12/50	Special Charts to Speed Use
			Rack Mounting
		12/52	Using for Xtal Freq Measuring
		4/59	<Surp> Mods & Power Supply
	Elect World	5/61	Improved Acc'y & Stability
	QST	3/47	Used as VFO
		5/47	<H&K> Power Supply
		5/48	Adding Modulation
			<H&K> Adding Modulation
		1/50	Used as VFO
			<H&K> Use on VHF
		2/50	Used as Audio Generator
		3/50	Calibrating
		5/50	<H&K> Null Indicator
		7/50	<H&K> Reduced Output
		8/53	Adding Bandspread

NOMENCLATURE	TITLE	DATE	COMMENTS
		1/56	Fast Interpolation
		3/58	<H&K> Used as SSB Inj Osc
		12/64	Extending Useful Range
		2/77	Solid State
	Radio Elect	8/50	Adding Modulation
	Radio/TV News	9/48	Used as CW/SSB Car Inj Osc
BC-224	Radio Elect	11/50	Power Supply (see BC-348)
BC-230, -430	73	6/63	Conv to 160-10 m Trans
BC-312, -342	E&E Vol I, III		
	CQ	2/59	<Surp> Converters for BC-312
	QST	9/46	Mods for Amateur Use
		12/47	Improved Selectivity
		8/51	<H&K> New IFs
		6/52	<H&K> Curing Backlash
		2/54	Adding a Crystal Filter
		12/58	Q-Multiplier for BC-342
	Radio Craftsman	1/48	Power Supply for BC-312
BC-348	E&E Vol I, III		
	CQ Sur Conv HB		
	R&M		
	73	6/63	Bandspreading
		6/64	Adding Bandspread Cap
		6/66	Improving Crystal Filter
		11/68	Dual Conversion
			Modernizing (Part 1)
		3/76	Modernizing (Part 2)
		1/78	Modernizing (Part 3)
	CQ	4/48	Modifications
		10/48	Reducing Drift
		12/48	Bandspread for 15 & 20 m
		4/49	Improved Gain & Select'y
		7/49	Low-Z Coupling for Coax In
		11/50	Triple Conv'n with BC-453
		7/53	85 kHz IFs for Select'y
		9/56	BC-946 as Q-5er
		2/59	<surp> Converters for BC-348
		3/59	P.S., Audio & NL
		5/59	S-meter & Crystal Phasing
		1/76	<SS> Discussion
	Ham Radio	2/69	Conversion to Solid State
	QST	1/47	Conversion
		6/47	Conversters for 10 & 11 m
		8/47	<H&K> Xtal Filter Repair
		11/47	Power Supply & Noise Filter
			Ant Input & Front End Improv
			Calibration
		2/48	<H&K> Eliminating Backlash
		6/48	BC-453 as Q-5er
			(4 versions)
		9/49	Converter for BC Band
		1/51	Curing Backlash
		2/52	Adding 10 meters

NOMENCLATURE	TITLE	DATE	COMMENTS
		6/54	<H&K> LF as Tuneable IF
		9/57	<H&K> Improved Calib & BFO
		7/59	<H&K> Alignment
BC-357	CQ	3/48	All-band Tx in Cabinet
		4/58	Carrier-operated Autocall
BC-406	CQ	2/46	On 10 meters
BC-412	E&E Vol I		
	Radio Craftsman	10/46	As an Oscilloscope
BC-603	E&E Vol III		
	CQ Sur Conv HB		
	CQ	9/58	Power Supply & On 6 meters
		10/58	<Surp> Conv to 6 m & AM
		12/58	<Surp> Simple AM
		12/59	Power Supply & 30-50 mHz
	HR	5/68	Conversion
BC-604	CQ	11/60	<Surp> Conversion
BC-605	Radio/TV News	4/50	As Intercom
BC-610	CQ	9/49	Mod'g Coils for Ham Use
	QST	7/48	Exciter Using Tuning Units
		9/49	<H&K> Relay Circuit Mods
		5/51	Cleaning Up TVI
		11/55	SSB Conversion
	Radio Elect	9/50	Tuning Units as VFOs
	Radio TV News	4/51	Cleaning Up TVI
BC-620	CQ Sur Conv HB		
BC-624, -625	E&E Vol I, III		
	CQ Sur Conv HB		
	R&M		
	73	8/62	Mounting the BC-625
		6/66	On 2 meters
	CQ	7/47	Rack mounted Tx & Rx
		5/48	BC-624 Audio Improvements
		6/48	BC-625 on 10 meters
		10/48	BC-625 Crystal Socket Mods
		7/49	BC-624 Noise Limiter
		11/53	BC-625 on 1-1/4 meters
		2/65	BC-625 on Inverted DSB
		10/69	<SS> Discussion
	QST	3/48	BC-624 FE as Converter
		5/48	BC-625 on 10 meters
			BC-625 on 10 meters
		6/48	BC-624 Added BFO
		4/49	BC-624 Impr Sens & N. Fig.
		11/56	BC-625 SSB with C.E. 20A
	Radio Craftsman	4/47	BC-625 Rack Mounted
		9/47	BC-624 Tuneable & Rack Mnt
		6/48	BC-624 as FM Broadcast Rx.
	Radio News	10/46	BC-624 Rack Mounted
		11/46	BC-625 Rack Mounted
		4/48	BC-625 on 10 & 6 meters
BC-645	E&E Vol I		
	CQ	12/56	On 3/4 meter

NOMENCLATURE	TITLE	DATE	COMMENTS
	QST	2/47	On 3/4 meter
BC-652	73	10/62	Power Supply
	CQ	10/65	Power Supply & 40 meters
BC-654	CQ	10/46	General Information
		3/47	Mobile Use
BC-659	CQ	5/59	<Surp> On 10 meters FM
		6/59	<Surp> Conversion to AM
		9/59	<Surp> Battery Substitution
BC-669	CQ Sur Conv HB		
	CQ	7/61	Conv to 80 & 40 m Novice Rig
BC-733	CQ	10/59	Conversion to 6 & 2 meters
BC-745, -746	CQ	3/54	VFO Using BC-746 Parts
	QST	1/48	Mini Tx Using BC-746 Parts
BC-788	QST	7/48	On 3/4 meters AM
BC-929	CQ	11/57	Into Oscilloscope
	QST	8/57	Into Oscilloscope
BC-1066	E&E Vol III		
BC-1068, -1168	E&E Vol I		
	CQ Sur Conv HB		
	CQ	6/48	On 2 meters
	Radio Craftsman	1/48	As Basis for TV Receiver
BC-1158	CQ	1/56	TU-75 on 6 meters
		1/57	Conversion to 6 meters
BC-1206	E&E Vol II		
	73	6/68	Conversion
	Ham Radio	10/70	Solid St & 40 m Converter
	Radio Elect	3/61	Use With CONSOLAN System
BC-1253	E&E Vol II		
BC-1284	CQ	2/47	As 2 meter Preamp
BC-1335	CQ	12/57	<Surp> On 10 meters
		12/58	<Surp> On 6 meters
		7/59	<Surp> Converted to AM
C-161 Coil	CQ	11/57	Used in Hybrid Phone Patch
		9/58	Used in Hybrid Phone Patch
HS-33	CQ	11/49	Element as Microphone
	Radio/TV News	12/51	As Phone Patch
I-83	CQ	11/60	As Bench Power Supply
I-155	CQ	1/65	Description
I-177	CQ	5/61	<Surp> Updating Adaptor
	QST	11/64	Updating
PE-101	CQ	8/52	Conversion Information
		12/52	Update for 8/52 Article
		5/54	Operation with 2 Batteries
		5/55	Improved Efficiency
			Operation on 6 volts
	QST	3/57	<H&K> Rewiring
RM-52, -53	E&E Vol III		
	CQ	10/58	RM-52 as Phone Patch
T-17 Mic	73	1/61	Using PTT as Remote Control
	CQ	2/49	Increased Output
		2/52	Using F-1 Element
		5/52	Using F-1 Element

NOMENCLATURE	TITLE	DATE	COMMENTS
		9/58	Improved Output
TG-34	QST	9/57	<H&K> Used to Key Tx's
VO-4	73	12/60	AC P.S. & as Xtal Std

NOMENCLATURE	TITLE	DATE	COMMENTS
ARB	73	6/64	General Description
	CQ	6/58	<Surp> Power Supply & Ctrls
ATK	CQ	9/63	Camera for ATV
		5/57	CRV-59AAE Camera Conversion
BN, BP	73	11/63	CFT-46ADT F.E. as 3/4 m Conv
	CQ	11/56	Front End as 2 m Converter
GF-11	CQ	1/57	80 & 40 m Mobile Trans
	QST	7/50	<H&K> Modified Keying
GO-9	E&E Vol II		
GP-7	Radio Elect	9/50	VFOs from Tuning Units
LM	E&E Vol II, III		
	73	9/66	Use on VHF
		5/71	Converted to Solid State
	CQ	10/65	Improved Accuracy
	QST	4/65	Calibrating
		9/65	Instructions for Use
LR-1	CQ	11/66	Instructions for Use
MAW	CQ	5/76	On 2 meters AM
MBF	E&E Vol III		
RAO, RAS	CQ	8/56	Bandspreading
RAX-1	73	2/63	Adding a 40 m Converter
RBA, RBB, RBC	CQ	11/66	<SS> Discussion
RBC	CQ	7/47	Adding an S-meter
RBJ, RCK, RCL	CQ	8/56	Bandspreading
RDR	73	8/62	Converted to 1-1/4 meter
	CQ	12/68	<SS> Discussion
RDZ	73	6/66	Multiband Using TV Tuner
		1/65	Power Supply
	CQ	4/60	<Surp> Amateur Conversion
		12/66	<SS> Discussion
TBS	CQ	5/58	Receiver on 6 meters
TBW	E&E Vol II		
TBX-8	CQ	7/58	<Surp> Conv to 80 m CW & AM
		9/59	<Surp> Schematic
TBY	E&E Vol I		
	CQ	9/57	<Surp> Xtal Control on 6 m
	Radio News	10/47	Operating on 10 & 6 meters
TCS	73	9/64	Transmitter Conversion
		3/69	Improved Transmitter Audio
	CQ	9/59	Power Supply & Crystal Mic
		11/60	Converted for 50 ohm Coax
TDQ	CQ	6/67	Converted to 2 meters

JAN/JETDS

NOMENCLATURE	TITLE	DATE	COMMENTS
AM-26/AIC	E&E Vol II		
AM-494/GR	73	5/71	Into 2 meter Amplifier
AM-914/TRC	CQ	10/80	As 225-400 mHz Converter
AM-1187/TRC	73	3/74	On 3/4 meter
AM-6155/GRT-22	73	12/85	400 - 500 watts on 1-1/4 m
AS-989	CQ	9/66	<SS> Description
		12/66	<SS> Description
C-131/AR	73	2/66	Autotune for Cmnd Receivers
CU-145/ARC	CQ	8/67	Auto-tuner for Linear Amp
CV-591/URR	CQ	10/76	<SS> Discussion
		11/76	<SS> Discussion
CV-763/URR	CQ	7/71	<SS> Discussion
F-237/U	Ham Radio	12/80	Converted to 6, 2 & 1-1/4 m
F-1039A/U	CQ	5/73	<SS> Discussion
ID-11/APS-4	CQ	3/61	<Surp> As Test Scope
ID-60/APG-5	CQ	8/58	Scope with Power Supply
IP-69/ALA-2	73	6/64	Controls & Power Supply
		6/68	Controls & Power Supply
		6/69	Into VHF Band Scanner
IP-274/ALA-10	73	6/69	Into VHF Band Scanner
KY-65/ARA-26	73	10/61	As Automatic CQ Sender
	CQ	5/65	As Automatic IDer
R-1/ARR-1	CQ	11/63	Into 1-1/4 meter Preamp
		3/66	<SS> Discussion
R-4/ARR-2	CQ	8/59	<Surp> On 2 m & Tuneable
		8/60	<surp> Improved Local Osc
		11/63	Front End as 1-1/4 m Preamp
		3/66	<SS> Discussion
R-5/ARN-7	QST	9/52	Coils in CW Receiver
R-9/APN-4	E&E Vol III		
R-19/TRC-1	CQ	7/65	Converted to 6 meters
R-44/ARR-5	73	6/64	Improved Sensitivity
	Radio Craftsman	9/48	Power Supply
R-45/ARR-7	73	12/62	Conversion & Power Supply
		6/64	Adding SSB
R-48/TRC-8	73	6/63	On 1-1/4 meters
	CQ	5/60	<Surp> On 1-1/4 meters AM
		6/60	<surp> On 2 meters
		7/62	On 1-1/4 meters
R-54/APR-4	QST	7/57	T.U. Butterfly as Wavemeter
R-89/ARN-5	Radio Elect	3/50	As FM Broadcast Receiver
R-105/ARR-15	73	6/64	General Notes
		6/65	Conversion
R-174/URR	73	1/75	Basic Conversion
	CQ	8/76	<SS> Discussion
		3/83	Discussion
R-257/U	CQ	10/60	<Surp> F.E. as 6 m Converter
R-320/FRC	CQ	2/57	F.E., Audio Improv, Prod Det

NOMENCLATURE	TITLE	DATE	COMMENTS
R-388/URR	CQ	4/68	General Improvements
		12/68	General Improvements
R-390/URR	CQ	1/65	Modifications
		1/68	Converted for SSB
		1/71	<SS> Discussion
	Ham Radio	7/74	Product Detector
		11/75	Modifications
R-392/URR	73	8/74	Power Supply
		11/75	Modifications
R-394/U	73	7/69	On 2 meters
	CQ	5/69	On 2 meters FM
R-417/TRC	Ham Radio	2/80	Filters on 2 meters
		3/80	Filters on 1-1/4 & 3/4 m
R-432/URR-21	CQ	10/66	<SS> Discussion
R-444/APR-4Y	QST	7/57	T.U. Butterfly as Wavemeter
	CQ	10/65	Conversion
R-445/ARN-30	CQ	3/67	<SS> Discussion
R-540/ARN-14	CQ	12/74	<SS> Discussion
R-648/ARR-41	73	11/78	Description & Power Supply
	CQ	5/74	<SS> Discussion
RT-7/APN-1	E&E Vol III		
	Radio/TV News	12/51	Sweep Gen from Wobulator
RT-18/ARC-1	CQ Sur Conv HB		
	73	6/68	Guard Receiver on 2 meters
	CQ	5/60	On 2 meters
RT-34/APS-13	E7E Vol II		
	73	6/68	Converted for ATV
	CQ	10/55	On 3/4 meter
	QST	5/48	On 3/4 meter
RT-67/GRC	CQ	9/76	On 10 meters
RT-68/GRC	CQ	9/76	On 6 meters
RT-70/GRC	73	11/76	On 6 meters FM
RT-77/GRC-9	73	2/85	On 80, 40 & 30 meters cw
	CQ	3/70	As 80 & 40 m Novice Rig
RT-82/APX-6	73	10/64	On 1296 mHz
	CQ	12/62	On 1296 mHz
		10/65	On 1215 mHz (Part 1)
		11/65	On 1215 mHz (Part 2)
	Ham Radio	4/68	Conversion Notes
	QST	9/60	On 1215 mHz
		2/61	Conversion Information
		6/61	<H&K> Moving to 1296 mHz
RT-91/ARC-2	73	10/62	Basic Conversion
		6/63	Improved Selectivity
		9/64	Adding SSB
	CQ	2/75	<SS> Discussion
RT-128/ARC-21	CQ	2/69	<SS> Discussion
RT-159/URC-4	E&E Vol III		
	CQ	10/65	On 6, 2 or 1-1/4 meters
		6/67	On 2 meters
		5/69	Power Supply
		11/70	<SS> Discussion

NOMENCLATURE	TITLE	DATE	COMMENTS
RT-178/ARC-27	73	12/63	Tx Chassis as 3/4 m Exciter
		6/65	Guard Receiver on 1-1/4 m
RT-209/PRC	73	6/68	On 2 meters FM
RT-264/APX	Ham Radio	3/81	On 1296 mHz
RT-285/URC-11	CQ	5/69	On 1-1/4 meters
			Power Supply
RT-294/ARC-44	CQ	5/75	<SS> Discussion
RT-311/ARC-38	CQ	5/75	<SS> Discussion
		6/76	<SS> Alignment
RT-594/ARC-38A	CQ	5/76	<SS> Discussion
		6/76	<SS> Alignment
RT-794/PRC-74	CQ	12/72	<SS> Discussion
T-14/TRC-1	CQ	4/64	On 6 meters AM & FM
T-28/APT-1	73	6/64	On 2 meters
T-39/APQ-9	CQ	2/50	On 3/4 meter
T-47/ART-13	E&E Vol III		
	CQ Sur Conv HB		
	73	5/62	Antenna Switch
		3/72	Basic Conversion & 10 meters
		3/74	Regulated Osc Screen
	CQ	11/46	Power Supply & 10 meters
		2/47	Pwr Sup & 3.4 to 30.6 mHz
		12/47	Sp. Amp with clip & Filter
		1/49	CFI Unit as Crystal Standard
		8/56	SSB Linear
		3/60	<Surp> Biblio of Prev Convs
	Ham Radio	8/69	Quiet Keying
	QST	9/56	CFI Xfmrs as Q-mult/Q-5er
		5/64	Adding FSK
	Radio News	12/46	Description & power Supply
T-51/ARQ-8	73	6/64	On 6 meters
T-195/GRC-19	CQ	9/75	<SS> Discussion
T-278/U	73	7/69	On 2 meters FM
		3/72	On 2 meters FM
		5/75	Into 2 meter Linear Amp
T-465/ALT-7	73	9/65	Reflectometer as SWR/Pwr Mtr
TH-5/TG	CQ	4/65	As RTTY Tx/Rx Converter
TS-1/ARR-1	QST	6/52	Into 3/4 meter Converter
		8/53	Into 3/4 meter Tank Circuit
TS-47/APR	Radio News	5/46	Description
TS-118/AP	73	6/64	Description
AN/APA-2	73	6/66	Into 2 meter Preamp
AN/APA-38	CQ	7/59	Into Panadaptor
AN/APR-1	QST	7/57	T.U. Butterfly as Wavemeter
AN/ARC-3	CQ Surp Conv HB		
	73	6/63	T-67 on 2 meters
		3/72	On 2 meters
	CQ	2/62	On 2 meters
		10/65	On 6 & 2 meters FSK
AN/ARC-58	CQ	2/66	<SS> Discussion
AN/ARC-65	CQ	4/71	<SS> Discuss & Basic Conv'n

NOMENCLATURE	TITLE	DATE	COMMENTS
AN/ARM-160	CQ	12/67	<SS> Discussion
AN/ART-26	73	6/63	On ATV
AN/CRC-7	E&E Vol III		
	CQ	4/58	<Surp> On 2 meterts
AN/DMQ-2	73	6/63	On 1-1/4 meters
	CQ	7/63	SSB Mixer/Amp for 1-1/4 m
AN/FRR-18,-19	CQ	12/71	<SS> Discussion
AN/FRR-20,-21	CQ	12/71	<SS> Discussion
AN/FRR-59	CQ	3/73	<SS> Discussion
AN/FRR-60	CQ	11/73	<SS> Discussion
AN/GPG-1	73	7/67	T-9 Tracker as SSTV Monitor
AN/MRR-1,-2,-3	CQ	12/71	<SS> Discussion
AN/PRD-7	CQ	10/67	<SS> Discussion
AN/SRR-11,-13	CQ	12/71	<SS> Discussion
AN/SSQ-23	73	3/70	On 2 meters FM
AN/TRA-1	73	3/73	As 6 or 2 meter Amp
AN/TRA-19	73	6/68	As 3/4 meter Amp
AN/URR-13	CQ	5/71	<SS> Discussion
AN/WRR-2	CQ	3/73	<SS> Discussion

Command Sets

NOMENCLATURE	TITLE	DATE	COMMENTS
BC-453	73	6/63	As Base for Receiver
	CQ	2/49	Base for 80 to 20 meter Rcvr
		6/49	As Q-5er
		10/49	On Broadcast Band
		11/50	Used with BC-348
		12/50	IF Xfmrs in Tight IF Channel
		7/53	IFs in Q-5er for BC-348
		1/56	With converters for 80 & 40 m
		9/56	With Convs for 80 to 20 m SSB
		1/60	With Converters
		11/64	Base for 80 & 40 m Xcvr
		10/65	Improved Q-5er
	QST	1/48	As Q-5er
		6/48	With BC-348 (Modified Coils)
			With BC-348 (Extern Osc)
			With BC-348 (Series Padded)
			With BC-348 (With Converter)
		9/48	IFs in Triple Conv Receiver
		3/49	<H&K> Improved Selectivity
		10/49	With Converter for 80 & 40 m
		11/49	<H&K> As Scope Vertical Amp
		8/50	With Converters for 10 m
		2/51	As Q-5er
		9/51	As Base for Ham Receiver
		4/53	Crystal F.E. for 1.3 kHz BW
		5/53	As Transceiver
		11/54	As Part of Panadaptor
		3/55	As 80 & 40 m SSB Receiver
		3/56	Base for Ham Receiver
		4/58	With Gonset Super-six
		9/59	As Tunable IF
		2/61	Base for Ham Receiver
	Radio/TV News	9/51	Tunable IF Above 500 kHz
BC-453, -454	CQ	2/58	As 20 to 10 meter Receiver
BC-453 - 455	QST	8/59	As Triple Conversion Rcvr
BC-454	CQ	1/50	As Station Monitor
		3/53	With Converter for 40 meters
		3/57	<Surp> As 6 m Transceiver
		5/69	Modified for Q-5er
	QST	7/49	<H&K> With Bcst Rec on 80 m
		10/52	<H&K> On 8 to 14 mHz
		9/53	With Converters for 10 & 6 m
		1/59	On 80 meters
		4/59	<H&K> Bandspreading
		1/60	Coil Data for 160 to 6 m
		12/60	NL, AVC & S-meter
		1/69	With Conv's for 15 & 10 m
BC-454, -455	CQ	3/53	As Heterodyne Exciters

NOMENCLATURE	TITLE	DATE	COMMENTS
	QST	3/60	Regen for Improved Select'y
	Radio/TV News	8/50	As 20 meter Receiver
BC-455	CQ	9/48	On 10 meters
		11/48	Bandspreading
		9/57	As 10 meter Converter
		4/59	As 6 meter Transceiver
		3/60	On 6950 to 7330 kHz
	QST	4/50	With HF Xtal Filt & Converter
		11/60	With 6 & 2 meter Converters
		1/61	As Mobile Receiver
		6/66	Operating Unconverted
	Radio Elect	12/48	With 455 kHz IFs
BC-946	CQ	9/56	With BC-348
R-23/ARC-5	CQ	12/62	As 80 meter Transceiver
R-25/ARC-5	CQ	6/68	As 40 meter Transceiver
R-26/ARC-5	CQ	12/64	As 80 meter Transceiver
R-27/ARC-5	CQ	10/65	As 40 meter Transceiver
R-28/ARC-5	CQ	12/53	Tunable
		6/57	<Surp> Mobile Fixed Freq Rec
Cmnd Rcvrs	73	4/61	Audio Improvements
		6/63	General Description
		9/63	HF IFs in VHF Receiver
		6/66	Conversions
		2/67	Attaching Knobs
		3/84	RF & IF Parts in 160 m Conv
	CQ	11/47	Power Supply & Conversions
		1/48	Tuning Crank
		6/48	Brute Force Bandspreading
		8/48	Receivers as Converters
		1/49	Tuning Knob
			Noise Limiter
		6/49	Tuning Knob
		10/49	Transformerless Power Supply
		3/53	Bandspread with Dial Vernier
		3/55	Repackaging for Rack Mount
		10/65	Crystal Control
		1/67	Retuning Information
		5/69	As SSB Transmitter
		12/70	<SS> Alignment
	QST	7/55	Precautions on Resistors
		12/56	Product Detector
		11/59	Parts in Phasing SSB Exciter
	Radio News	6/48	Conversion & Converters
	Radio/TV News	5/53	IFs in Mobile Rig
BC-457	CQ	6/53	On 160 meters
	QST	11/51	As Novice Transmitter
		3/53	<H&K> Improved Keying
BC-457, -458	QST	2/52	<H&K> Bandspreading
BC-457, -459	QST	11/59	Crystal Controlled
BC-457, -696	CQ	4/49	On 20 meters
		3/57	On 80 meters DSB
BC-458	CQ	10/49	Into TVI-free 813 Tx (pt 1)

NOMENCLATURE	TITLE	DATE	COMMENTS
		11/49	Into TVI-free 813 Tx (pt 2)
		10/57	Converter for 10 m SSB Excit
		2/60	On DSB
		2/61	Keying & Other Mods
			As Multiband VFO
		1/62	On 10 meters
		7/69	As 40 meter Linear Amplifier
	QST	3/56	On SSB
		2/57	As Heterodyne VFO for SSB
		8/59	On 15 meters SSB
BC-458, -459	CQ	7/48	As 10 meter & VHF VFOs
		4/51	On 10 meters
		5/51	On 6 meters
		8/52	On 15 meters
BC-459	73	11/60	As FM VFO
	CQ	3/48	On 40 & 20 meters
		7/48	On 40 & 20 meters
		2/49	On 40 & 20 meters
		6/50	On 40 meters & De-TVIed
		6/57	As Mobile Rig
	QST	6/48	On 20 meters
			As NBFM VFO
		11/53	As Heterdyne Exciter
		12/57	As Overtone VFO
		7/63	<H&K> Keying Improvements
BC-696	CQ	2/50	Stabilizing
		7/57	On DSB
	QST	3/48	On 80 meters
		7/51	Keying
		12/53	De-TVIed
T-18/ARC-5	CQ	4/75	On 160 & 80 meters
	QST	2/63	On 160 & 80 meters
T-20/ARC-5	CQ	2/73	As VFO
	QST	11/51	As Novice Transmitter
T-22/ARC-5	CQ	5/69	As FM VFO for 2 meters
T-23/ARC-5	73	5/62	On 6, 2 & 1-1/4 meters
	CQ	4/57	On 2 meters
		6/59	On 2 meters
		6/60	On 2 meters (Part 1)
		7/60	On 2 meters (Part 2)
			On 6 meters
	QST	11/50	De-TVIing
		5/60	On 2 meters SSB
Cmnd Trans	73	7/62	As All-band VFO
		6/63	Improved Oscillator Stability
		6/68	As Receiver Front End
		9/78	Coil & Caps in Antenna Tuner
	CQ	5/46	As AM & FM VFO
		1/48	As 10 m, 6 vdc Mobile Rig
		7/48	Rack Mounted
			Adding Coax Connectors
		8/48	Band Spreading

NOMENCLATURE	TITLE	DATE	COMMENTS
		4/49	Keying Filter
		6/49	Voltage Regulation
		9/49	P. S. & Screen Modulator
		2/50	Chassis for Modulator
		3/50	De-TVIing
		8/50	Keying & Modifications
		9/52	Grid-Block Keying
		4/53	Crystal Control Adaptor
		8/54	QSK Keying
		5/55	Roll Coil in Rem Ant Tuner
		7/55	Rebuilt as VFO
		5/58	<Surp> As 250 watt Linear Amp
		12/58	As Base for Linear Amp
		5/61	On DSB
			Parts in 400 watt Linear Amp
		11/62	As VFO

Miscellaneous

SUBJECT	TITLE	DATE	COMMENTS
A.R.C. Type 12	73	9/63	R-11 (R-510,-511) As Q-5ers
		6/64	TV-10A on 1-1/4 meters
		6/65	R-19 (R-508) on 2 meters
		1/75	R-11 (R-510,-511): Added BFO
		4/75	R-11(R-510,-511) As Q-5ers
	CQ	9/68	<SS> Discussion (Trans)
Bendix MN-26Y	QST	12/52	As 80 meter Transceiver
Bendix TA-12	E&E Vol II		
Collins 51J-	CQ	4/68	Improvements
		12/68	Improvements
Collins 51M-2	CQ	5/66	<SS> Discussion
Hammerlund SPs	CQ Surp Conv HB		
	73	1/61	Improved Stability
		2/61	Power Supply for Older Sets
	CQ	5/48	Improved Stability
		10/52	Improved Stability
		9/58	Prod Det, AGC & Stabilizing
		4/61	Conversions
		7/65	Product Detector
		1/75	<SS> SP-600 Discussion
		4/76	SP-600: Bandspread Aux Dial
		1/79	Conversions
	QST	2/57	<H&K> Stabiliz'g & Audio Impr
		8/70	Updates
Meissner 150B	QST	9/47	On 20 meters
		5/48	<H&K> Full Break-in Keying
National (Mil)	CQ	8/56	Bandspreading
National HRO	CQ	22/49	Front End & Osc Stability
RCA AVT-112	E&E Vol II		
Wilcox F-3	QST	9/48	On FM
Misc	73	10/60	Suggestions for Using Surplus
		11/62	Replacing Numbered Tubes
		3/71	JETDS Nomenclature System
		8/77	Reconditioning Equipment
	CQ	12/45	General Discussion
		3/46	Update on Surplus
		4/46	Update on Surplus
		4/50	Prop Pitch Motors as Rotors
		9/56	General Discussion
		7/59	Prop Pitch Motors as Rotors
		10/59	<HC> Available Equipment
		1/64	Using Surplus Reflectometers
		2/71	<SS> Surplus Portable Sets
		9/72	<SS> RTTY, FAX etc Converters
		11/72	<SS> JAN Nomenclature System
		4/76	<SS> D-2 Inverter System
	QST	4/78	<TT> Buying Surplus
	Radio Craftsman	8/48	List of Conversions

SUBJECT	TITLE	DATE	COMMENTS
	Radio Elect	10/50	List of Conversions
	Radio/TV News	9/48	Negative Look at Conversion
Misc (Recs)	73	3/78	Updating old Receivers
		12/79	Audio Amp for Surplus Rcvrs
	CQ	3/67	Adding Product Detectors
	QST	12/49	Tuning Knobless Controls
		2/51	<H&K> Restoring Performance
Misc (Trans)	73	9/62	Keying Surplus Transmitters
Misc (Audio)	73	3/61	Audio Impedance Matching
	CQ	3/46	Filters for Sharp Selectivity
		6/48	Surplus Filters
Selsyns	CQ	5/46	General Information
		2/48	Used as Antenna Rotors
		3/48	Used for Remote Control VFO
		4/48	Antenna Position Indicator
		11/53	Servo Antenna Heading Control
		9/56	General Information
		7/59	Antenna Position Indicator
	QST	5/47	General Information
		5/67	Antenna Position Indicator
		10/79	Antenna Position Indicator

YR	MO	SUBJECT	COMMENTS
60	10	Misc	Suggestions for Using Surplus
	11	BC-459	As FM VFO
	12	VO-4	AC P.S. & Used as Xtal Std
61	1	Hammerlund SPs	Improved Stability
		T-17 Mic	Using PTT for Remote Control
	2	Hammerlund SPs	Power Supply for Older Sets
	3	Misc (Audio)	Audio Impedance Matching
	4	Command Rcvrs	Audio Improvements
	10	KY-65/ARA-26	As Automatic CQ Sender
62	5	MD-7/ARC-5	As Modulator
		T-23/ARC-5	On 6, 2 & 1-1/4 meters
		T-47/ART-13	Antenna Switch
	7	Cmnd Trans	As All-band VFO
	8	BC-625	Mounting
		RDR	Converting to 220 mHz
	9	Misc (Trans)	Keying Surplus Transmitters
	10	BC-652	Power Supply
		RT-91/ARC-2	Basic Conversion for 80 & 40 meters
	11	Misc	Replacing Numbered Tubes
	12	R-45/ARR-7	Conversion & Power Supply
63	2	RAX-1	Adding a 40 m Converter
	6	AN/ARC-3	T-67 on 2 meters
		AN/ART-26	On ATV
		AN/DMQ-2	On 1-1/4 meters
		BC-230, -430	Conv to 160 to 10 m Tx's
		BC-348	Bandspreading
		BC-453	As Base for Receiver
		Cmnd Rcvrs	General Description
		Cmnd Trans	Improved Osc Stability
		R-48/TRC-8	On 1-1/4 meters
		RT-91/ARC-2	Improved Selectivity
	9	A.R.C. Type 12	R-11 (R-510, -511) as Q-5ers
		Cmnd Rcvrs	HF IFs in VHF Receiver
	11	BN, BP	CFT-46ADT F.E. as 3/4 m Conv
	12	RT-178/ARC-27	Tx Chassis as 3/4 m Exciter
64	6	A.R.C. Type 12	TV-10A on 1-1/4 meters
		ARB	General Description
		BC-348	Adding Bandspread Cap
		IP-69/ALA-2	Controls & Power Supply
		R-44/ARR-5	Improved Sensitivity
		R-45/ARR-7	Adding SSB
		R-105/ARR-15	General Notes
		T-28/APT-1	On 2 meters
		T-51/ARQ-8	On 6 meters
		TS-118/AP	Description
	9	RT-91/ARC-2	Adding SSB
		TCS	Transmitter Conversion
	10	RT-82/APX-6	On 1290 mHz

YR	MO	SUBJECT	COMMENTS
65	1	RDZ	Power Supply
	6	A.R.C. Type 12	R-19 (R-508) on 2 meters
		R-105/ARR-15	Conversion
		RT-178/ARC-27	Guard Receiver on 1-1/4 meters
	9	T-465/ALT-7	Reflectometer into SWR/Pwr Mtr
66	2	C-131/AR	Autotune for Command Receivers
	6	AN/APA-2	Into 2 meter Preamp
		BC-348	Improving Crystal Filter
		BC-624, -625	On 2 meters
		Cmnd Rcvrs	Conversions
		RDZ	Multiband with TV Tuner
	9	BC-221 & LM	Use on VHF
67	2	Cmnd Rcvrs	Attaching Knobs
	7	AN/GPG-1	T-9 Tracker as SSTV Monitor
68	6	AN/TRA-19	As 3/4 meter Amp
		BC-1206	Conversion
		Cmnd Trans	As Receiver Front End
		IP-69/ALA-2	Controls & Power Supply
		RT-18/ARC-1	Guard Receiver on 2 meters
		RT-34/APS-13	Converted for ATV
		RT-209/PRC	On 2 meters FM
	11	BC-348	Dual Conversion Modernizing (Part 1)
69	3	TCS	Improving Transmitter Audio
	6	IP-69/ALA-2 & IP-274/ALA-10	Into VHF Band Scanner
	7	R-394/U	On 2 meters
		T-278/U	On 2 meters FM
70	3	AN/SSQ-23	On 2 meters FM
		Cmnd Ant Relay	As RF Wattmeter
71	3	Misc	JETDS Nomenclature System
	5	AM-494/GR	Into 2 meter Amplifier
		LM	Converted to Solid State
72	3	AN/ARC-3	On 2 meters
		T-47/ART-13	Basic Conversion & 10 meters
		T-278/U	On 2 meters FM
		AN/TRA-1	As 6 or 2 meter Amp
74	3	AM-1187/TRc	On 3/4 meter
		T-47/ART-13	Regulated Oscillator Screen
	8	R-392/URR	Power Supply
75	1	A.R.C. Type 12	R-11 (R-510, -511) Added BFO
		R-174/URR	Basic Conversion
	4	A.R.C. Type 12	R-11 (R-510, -511) as Q-5er
	5	T-278/U	Into 2 meter Linear Amp
76	3	BC-348	Modernizing (Part 2)
	11	RT-70/GRC	On 6 meters FM
77	8	Misc	Reconditioning Equipment
78	1	BC-348	Modernizing (Part 3)
	3	Misc (Recs)	Updating Old Receivers
	9	Cmnd Trans	Caps & Coil in Antenna Tuner
	11	R-648/ARR-41	Description & Power Supply
79	12	Misc (Recs)	Audio Amp for Surplus Rcvrs

YR	MO	SUBJECT	COMMENTS
84	3	Cmnd Rcvrs	RF & IF Parts in 160 m Conv
85	2	RT-77/GRC-9	On 80, 40 & 30 meters cw
	12	AM-6155/GRT-22	400 - 500 watts on 1-1/4 m

CQ magazine

YR	MO	SUBJECT	COMMENTS
45	12	Misc	General Discussion
46	2	BC-406	On 10 meters
	3	Misc	Update on Surplus
		Misc (Audio)	Filters for Sharp Selectivity
	4	Misc	Update on Surplus
	5	Cmnd Trans	As AM & FM VFO
		Selsyns	General Information
	10	BC-654	General Information
	11	T-47/ART-13	Power Supply & 10 meters
47	2	T-47/ART-13	Power Supply & 3.4 to 30.6 mHz
	3	BC-654	Mobile Use
		BC-1284	As 2 meter Preamp
	4	BC-221	Power Supply
	7	BC-624, -625	Rackmounted
		RBC	Adding an S-meter
	11	Cmnd Rcvrs	Power Supply & Conversions
	12	T-47/ART-13	Sp. Amp with Clip. & Filter
48	1	BC-221	General Information
		Cmnd Rcvrs	Tuning Crank
		Cmnd Trans	As 10 meter, 6 v Rig
	2	Selsyns	Used as Antenna Rotors
	3	BC-357	All Band Tx in Cabinet
		BC-459	On 40 & 20 meters
		Selsyns	Used for Remote Control VFO
	4	BC-348	Many Modifications
		Selsyns	Antenna Position Indicator
	5	Hammerlund SPs	Improved Stability
	6	BC-625	On 10 meters
		BC-1068, -1168	On 2 meters
		Cmnd Rcvrs	Brute Force Bandspreading
		Misc (Audio)	Surplus Filters
	7	BC-458, -459	As 10 meter & VHF VFOs
		BC-459	On 40 & 20 meters
		Cmnd Trans	Rack Mounted
			Adding Coax Connectors
	8	Cmnd Rcvrs	Receivers as Converters
		Cmnd Trans	Bandspreading
	9	BC-455	On 10 meters
	10	BC-221	Null Indicator
		BC-348	Reduced Drift
		BC-625	Crystal Socket Mods
		Cmnd Set Rigs	Portable Station
	11	BC-455	Bandspreading
	12	BC-348	Bandspread for 15 & 20 meters
49	1	Cmnd Rcvrs	Tuning Knob
			Noise Limiter
		T-47/ART-13	CFI Unit as Crystal Standard
	2	BC-453	Base for 80 to 20 m Receiver

YR	MO	SUBJECT	COMMENTS
		BC-459	On 40 & 20 meters
		National HROs	Front End & Osc Stability
		T-17 Mic	Increased Output
	4	BC-348	Improved Gain & Stability
		BC-457, -696	On 20 meters
		Cmnd Trans	Keying Filter
	5	BC-191, -375	Conversion with 826 in PA
	6	BC-453	As Q-5er
		Cmnd Rcvrs	Tuning Knob
		Cmnd Trans	Voltage Regulation
	7	BC-348	Low-Z Coupling for Coax Input
		BC-624	Noise Limiter Improvements
	8	BC-221	Adding Modulation
	9	BC-610	Mod'g Coils for Ham Use
		Cmnd Trans	P.S. & Screen Modulator
	10	BC-453	On Broadcast Band
		BC-458	Base for TVIfree 813 Tx (Pt 1)
		Cmnd Rcvrs	Transformerless Power Supply
	11	BC-458	Base for TVIfree 813 Tx (Pt 2)
		Cmnd Set Rigs	BC-457,-459 + -454,-455 Sta'n
		HS-33	ANB-H-1 Element as Mic
50	1	BC-221	Special Charts to Speed Use
			Rack Mounting
		BC-454	As Station Monitor
	2	BC-191, -375	Components in Antenna Tuner
		BC-696	Stabilizing
		Cmnd Trans	Chassis for Modulator
		T-39/APQ-2	On 3/4 meter
	3	Cmnd Trans	De-TVIing
	4	Cmnd Set Misc	Substitutes for PL-153 Plug
		Misc	Prop Pitch Motors as Rotors
	6	BC-459	On 40 meters & De-TVIed
	7	Cmnd Ant Relay	Case for 75 m AM Tx
	8	Cmnd Trans	Keying & Modifications
	11	BC-348 & -453	Triple Conversion Receiver
	12	BC-453	IF Xfmrs in Tight IF Channel
51	4	BC-458, -459	On 10 meters
	5	BC-458, -459	On 6 meters
52	2	T-17 Mic	Using F-1 Element
	5	T-17 Mic	Using F-1 Element
	8	BC-458, -459	On 15 meters
		PE-101	Conversion Information
	9	Cmnd Trans	Grid Block Keying
	10	Hammerlund SPs	Improved Stability
	12	BC-221	Using for Xtal Freq Measurement
		PE-101	Update for 8/52 Article
53	3	BC-454	With Converter for 40 meters
		BC-454, -455	As Heterodyne Exciters
		Cmnd Rcvrs	Bandspread with Vernier Dial
	4	Cmnd Trans	Crystal Control Adaptor
	6	BC-457	On 160 meters
	7	BC-348	Using 85 kHz IFs for Select'y

YR	MO	SUBJECT	COMMENTS
		BC-453	IFs in Q-5er for BC-348
	11	BC-625	On 1-1/4 meters
		Selsyns	Servo Antenna Heading Control
	12	R-28/ARC-5	Tuneable
54	3	BC-746	Parts in VFO
	8	Cmnd Trans	QSK Keying
	12	BC-191, -375	TU as Exciter Foundation
55	3	Cmnd Rcvrs	Repackage for Rack Mount
	5	Cmnd Trans	Roll Coil in Remote Ant. Tuner
		PE-101	Rewired for Better Efficiency Operation on 6 volts
	7	Cmnd Trans	Rebuilt as VFO
	9	BC-191, -375	Components in Transmitter
	10	RT-34/APS-13	On 3/4 meter
56	1	BC-453	With Converters for 80 & 40 meters
		BC-1158	TU-75 on 6 meters
	8	National (mil)	Bandspreading
		T-47/ART-13	SSB Linear
	9	BC-348, -946	Using BC-946 as BC-348 Q-5er
		BC-453	With Convs for 80 to 20 m SSB
		Misc	General Discussion
		Selsyns	General Information
	11	BN, BP	Front End as 2 m Converter
	12	BC-645	On 3/4 meter
57	1	BC-1158	Conversion to 6 meters
		GF-11	80 & 40 meter Transmitter
	2	R-320/FRC	F.E., Audio Improv. & Prod Det
	3	BC-454	<surp> With Conv & Osc for 6 m
		B457, -696	On 80 meters DSB
	4	T-23/ARC-5	On 2 meters
	5	ATK	CRV-59AAE Camera Conversion
		BC-191, -375	Components in Mobile Trans
	6	BC-459	As a Mobile Rig
		R-28/ARC-5	<Surp> Mobile Fixed Freq Rcvr
	7	BC-696	On DSB
	9	BC-455	As 10 meter Converter
		TBY	<Surp> Crystal Control on 6 m
	10	BC-458	Converter for 10 m SSB Exciter
	11	BC-929	Into Oscilloscope
		C-161 Coil	In Hybrid Phone Patch
	12	BC-1335	<Surp> On 10 & 11 meters
58	2	BC-453, -454	As 20 to 10 meter Receiver
	4	AN/CRC-7	<Surp> On 2 meters
		BC-357	Carrier Controlled Autocall
	5	BC-624	Audio Improvements
		Cmnd Trans	<Surp> As 250 watt Linear
		TBS	Receiver on 6 meters
	6	ARB	<Surp> Power Supply & Controls
	7	Cmnd Ant Relay	RF Ammeter for Coax Lines
		TBX-8	<Surp> Conv to 80 m CW & AM
	8	ID-60/APG-5	Scope with Power Supply
	9	BC-603	Power Supply & 6 meters

YR	MO	SUBJECT	COMMENTS
		C-161 Coil	In Hybrid Phone Patch
		Hammerlund SPs	Prod Det, AGC & Stabilizing
		T-17 Mic	Improved Output
	10	BC-603	<Surp> Conv to 6 m & AM
		RM-52	As Phone Patch
	12	BC-603	<Surp> Simple AM
		BC-1335	<Surp> On 6 meters
		Cmnd Trans	<Surp> As Base for Linear Amp
59	1	BC-191, -375	Components in 900 watt Linear
	2	BC-312, -342	<Surp> with Converters
		BC-348	<Surp> with Converters
	3	BC-348	<Surp> P.S., Audio & N.L.
	4	BC-221	<Surp> Mods & Power Supply
		BC-455	As 6 meter Transceiver
	5	BC-348	S-meter & Crystal Phasing
		BC-659	<Surp> On 10 meters FM
	6	BC-659	<Surp> On AM
		T-23/ARC-5	On 2 meters SSB
	7	AN/APA-38	Into Panadaptor
		BC-191, -375	Tap Switch as Antenna Switch
		BC-1335	<Surp> Converted to AM
		Misc	Prop Pitch Motors as Rotors
		Selsyns	Antenna Position Indicator
	8	R-4/ARR-2	<Surp> On2 m & Tuneable
	9	BC-659	<Surp> Battery Substitution
		TBX-8	<Surp> Schematic
		TCS	Power Supply & Crystal Mic
	10	BC-733	Conversion to 6 & 2 meters
		Misc	<HC> Available Equipment
	12	BC-603	Power Supply & 30 to 50 mHz
60	1	BC-453	With Converters
	2	BC-458	On DSB
	3	BC-455	On 6950 to 7330 kHz
		Cmnd Ant Relay	Coax Lines & Built-in Pwr Sup
		T-47/ART-13	<surp> Biblio of Prev Convs
	4	RDZ	<Surp> Amateur Conversion
	5	BC-191, -375	Parts in 80 to 20 m CW Tx
		R-48/TRC-8	<Surp> On 1-1/4 meters AM
		RT-18/ARC-1	On 2 meters & Power Supply
	6	R-48/TRC-8	<Surp> On 2 meters
		T-23/ARC-5	On 2 meters (Part 1)
	7	T-23/ARC-5	On 2 meters (Part 2)
			On 6 meters
	8	R-4/ARR-2	<Surp> Improved Local Osc
	10	R-257/U	<Surp> F.E. As 6 m Converter
	11	BC-604	<Surp> Conversion
		I-83	As Bench Power Supply
		TCS	Converted for 50 ohm Coax
61	2	BC-458	Keying & Other Modss
			As Multiband VFO
	3	ID-11/APS-4	<Surp> As Test Scope
	4	Hammerlund SPs	Conversions

YR	MO	SUBJECT	COMMENTS
	5	BC-191, -375	Components in 400 watt Linear
		Cmnd Trans	On DSB
			Parts in 400 watt Linear Amp
		I-177	<Surp> Adaptor for Newer Tubes
	7	BC-669	Conv to 80 & 40 m Novice Rig
62	1	BC-458	On 10 meters
	2	AN/ARC-3	On 2 meters
	7	R-48/TRC-8	Converted to 1-1/4 meters
	11	Cmnd Trans	As VFO
	12	R-24/ARC-5	As 80 meter Transceiver
		RT-82/APX-6	On 1296 mHz
63	7	AN/DMQ-2	SSB Mixer/AMP for 1-1/4 meters
	9	ATK	Camera for ATV
	11	R-1/ARR-1 &	As 1-1/4 meter Preamp
		R-4/ARR-2	
64	1	Misc	Using Surplus Reflectometers
	4	T-14/TRC-1	On 6 meters AM & FM
	11	BC-453	Base for 80 & 40 m Transceiver
	12	R-26/ARC-5	As 80 meter Transceiver
65	1	I-155	Description
		R-390/URR	Modifications
	2	BC-625	On Inverted DSB
	4	TH-5/TG	As RTTY Tx & Rx Converter
	5	KY-65/ARA-26	As Automatic IDer
	7	Hammerlund SPs	Product Detector
		R-19/TRC-1	Converted to 6 meters
	10	AN/ARC-3	On 6 & 2 meters FSK
		BC-453	Improved Q-5er
		BC-652	Power Supply & 40 meters
		Cmnd Rcvrs	Crystal Controlled
		LM	Improved Accuracy
		R-27/ARC-5	As 40 meter Transceiver
		R-444/APR-4Y	Conversion
		RT-82/APX-6	On 1215 mHz (Part 1)
		RT-159/URC-4	On 6, 2 or 1-1/4 meters
	11	RT-82/APX-6	On 1215 mHz (Part 2)
66	2	AN/ARC-58	<SS> Discussion
	3	R-1/ARR-1 &	<SS> Discussion
		R-4/ARR-2	
	5	Collins 51M-2	<SS> Discussion
	9	AS-989	<SS> Discussion
	10	R-432/URR-21	<SS> Discussion
	11	LR-1	Instructions for Use
		RBA, RBB, RBC	<SS> Discussion
	12	RDZ	<SS> Discussion
		AS-989	<SS> Discussion
67	1	Cmnd Rcvrs	Retuning Information
	3	Misc (Rcvrs)	Adding Product Detectors
		R-445/ARN-30	<SS> Discussion
	6	RT-159/URC-4	On 2 meters
		TDQ	On 2 meters
	8	CU-145/ARC	Into Auto-tuner for Linear Amp

YR	MO	SUBJECT	COMMENTS
	10	AN/PRD-7	<SS> Discussion
	12	AN/ARM-160	<SS> Discussion
68	1	R-390/URR	Converted for SSB
	4	Collins 51J-	Improvements
		R-388/URR	General Improvements
	6	R-25/ARC-5	As 40 meter Transcaiver
	9	A.R.C. Type 12	<SS> Trans: Discussion
	12	Collins 51J-	Improvements
		R-388/URR	General Improvements
		RDR	<SS> Discussion
69	2	RT-128/ARC-21	<SS> Discussion
	5	BC-454	Modified for Q-5er
		Cmnd Rcvrs	As SSB Transmitter
		RT-159/URC-4 &	Power Supply
		RT-285/URC-11	
		RT-285/URC-11	On 1-1/4 meters
		T-22/ARC-5	As FM VFO for 2 meters
	7	BC-458	As 40 meter Linear Amplifier
	9	Cmnd Trans	As 200 watt Grounded Grid Amp
	10	BC-624, -625	<SS> Conversion
70	3	RT-77/GRC-9	As 80 & 40 m Novice Rig
	6	Cmnd Trans	Chassis for Linear Amp
	11	RT-159/URC-4	<SS> Discussion
	12	Cmnd Rcvrs	<SS> Discussion
71	1	R-390/URR	<SS> Discussion
	2	Misc	<SS> Surplus Portable Sets
	4	AN/ARC-65	<SS> Discuss. & Basic Conv'n
	5	AN/URR-13	<SS> Discussion
	7	CV-763/URR	<SS> Discussion
	12	AN/FRR-18, -19,	<SS> Discussion
		-20, -21,	
		AN/MRR-1, -2, -3,	
		AN/SRR-11, -13	
72	9	Misc	<SS> RTTY, FAX, etc Converters
	11	Misc	<SS> JAN Nomenclature System
	12	RT-794/PRC-74	<SS> Discussion
73	2	T-20/ARC-5	As VFO
	3	AN/FRR-59 &	<SS> Discussion
		AN/WRR-2	
	5	F-1039A/U	<SS> Discussion
	11	AN/FRR-60	<SS> Discussion
74	5	R-648/ARR-41	<SS> Discussion
	12	R-540/ARN-14	<SS> Discussion
75	1	Hammerl. SP-600	<SS> Discussion
	2	RT-91/ARC-2	<SS> Discussion & Power Supply
	4	T-18/ARC-5	On 160 & 80 meters
	5	RT-294/ARC-44	<SS> Discussion
	9	T-195/GRC-19	<SS> Discussion
76	1	BC-348	<SS> Discussion
	4	Hammerl. SP-600	Bandspread Auxiliary Dial
		Misc	<SS> D-2 Inverter Supply
	5	MAW	On 2 meters AM

YR	MO	SUBJECT	COMMENTS
		RT-311/ARC-38 & RT-594/ARC-38A	<SS> Discussion
	6	RT-311/ARC-38 & RT-594/ARC-38A	<SS> Alignment
	8	R-174/URR	<SS> Discussion
	9	RT-67/GRC	On 10 meters
		RT-68/GRC	On 6 meters
	10	CV-591/URR	<SS> Discussion
	11	CV-591/URR	<SS> Discussion
79	1	Hammerlund SPs	Conversions
80	10	AM-914/TRC	As 225-400 mHz Converter
83	3	R-174/GRR-5	Discussion

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YR	MO	SUBJECT	COMMENTS
46	9	BC-312, -342	Mods for Amateur Use
	12	BC-191, -375	Conversion Info
47	1	BC-348	Conversion
	2	BC-645	On 3/4 meter
	3	BC-221	Used as VFO
	5	BC-221	<H&K> Power Supply
		Selsyns	General Information
	6	BC-348	Converters for 10 & 11 meters
	7	BC-191, -375	TU Components in VFO
	8	BC-348	<H&K> Crystal Filter Repair
	9	Meissner 150B	On 20 meters
	11	BC-348	Power Supply & Noise Limiter
			Ant Input & Front End Improv
			Calibration
	12	BC-312, -342	Improved Selectivity
48	1	BC-453	As Q-5er
		BC-746	Parts in Mini-Transmitter
	2	BC-348	<H&K> Eliminating Backlash
	3	BC-624	Front End as Converter
		BC-696	On 80 meters
	5	BC-221	Adding Modulation
			<H&K> Adding Modulation
		BC-625	On 10 meters
		Meissner 150B	<H&K> Full Break-in Keying
		RT-34/APS-13	On 3/4 meter
	6	BC-348, 453	BC-453 as Q-5er (Coil Change)
			BC-453 as Q-5er (Extern Osc)
			BC-453 as Q-5er (Cap Change)
			BC-453 as Q-5er (Converter)
		BC-459	On 20 meters
			As NBFM VFO
		BC-624	Added BFO
		Cmnd Trans	Using the Tuning Eye
			Removing the Tuning Eye
			Improved Keying
	7	BC-610	Exciter using Tuning Units
		BC-788	On 3/4 meter AM
	9	BC-191, -375	TU Components in Trans
		BC-453	IFs in Triple Conv Receiver
		Wilcox F-3	On FM
	10	BC-191, -375	TU Components in Trans
49	3	BC-453	<H&K> Improved Selectivity
	4	BC-624	Improved Sens'y & Noise Figure
	7	BC-454	<H&K> With Bcst Rcvr on 809 meters
	9	BC-348	Converter for Broadcast Band
		BC-610	<H&K> Relay Circuit Mods
		Cmnd Set Misc	<H&K> Dynam. as Rotor Pillow
			<H&K> Dynamotors on 115 vac

YR	MO	SUBJECT	COMMENTS
	10	BC-191, -375	<H&K> Using Caps in VFO
		BC-453	With Converter for 80 & 40 m
		Cmnd Trans	<H&K> Eliminating Chirp
	11	BC-453	<H&K> As Scope Vertical Amp
	12	Misc (Rcvrs)	Tuning Knobless Controls
50	1	BC-221	Used as VFO
			<H&K> Used on VHF
		Cmnd Trans	As Plug-in Exciters
	2	BC-221	Used as an Audio Generator
	3	BC-221	Calibrating
	4	BC-455	With HF Xtal Filt & Converter
	5	BC-221	<H&K> Null Indicator
	7	GF-11	<H&K> Modified Keying Circuit
	8	BC-453	With Converter for 10 meters
	10	BC-191, -375	Enclosure for VHf Freq Meter
	11	T-23/ARC-5	De-TVIing
51	1	BC-348	Curing Backlash
	2	BC-453	As Q-5er
		Misc (Rcvrs)	<H&K> Restoring Performance
	5	BC-610	De-TVIing
	7	BC-696	Keying
	8	BC-312, -342	<H&K> New IFs
	9	BC-191, -375	<H&K> Identifying TU Caps
		BC-453	Base for Ham Receiver
	11	BC-457 &	As Novice Transmitter
		T-20/ARC-5	
52	2	BC-348	Adding 10 meters
		BC-457, -458	<H&K> Bandspreading
	6	BC-312, -342	<H&K> Curing Backlash
		TS-1/ARR-1	Into 3/4 meter Converter
	9	R-5/ARN-7	Coils in CW Receiver
	10	BC-454	<H&K> On 8 to 14 mHz
	12	Bendix MN-26Y	As 80 meter Transceiver
		Cmnd Trans	<H&K> Crystal Control Adaptor
53	3	BC-457	<H&K> Improved Keying
	4	BC-453	Xtal FE for 1.3 kHz Bandwidth
	5	BC-453	As Transceiver
	7	BC-221	<H&K> Reduced Output
	8	BC-221	Adding Bandspread
		TS-1/ARR-1	Into 3/4 meter Tank Circuit
	9	BC-454	With Converters for 10 & 6 meters
	11	BC-459	As Heterodyne Exciter
	12	BC-696	De-TVIed
		Cmnd Trans	Roll Coil in Remote Ant Tuner
54	2	BC-312, -342	Adding a Crystal Filter
	6	BC-191, -375	Components in 813 Transmitter
		BC-348	<H&K> LF Band as Tunable IF
	11	BC-453	As Part of Panadaptor
55	3	BC-453	As 80 & 40 m SSB Recaiver
	4	Cmnd Trans	<H&K> 6 Volt Relay Operation
	5	Cmnd Trans	Roller Coil in Ant. Auto-tuner
	6	R-23/ARC-5	Mobile with Gonset Converter

YR	MO	SUBJECT	COMMENTS
	7	Cmnd Rcvrs	<H&K> Precautions on Resistors
	10	Cmnd Trans	Roller Coil in Antenna Tuner
	11	BC-610	SSB Conversion
56	1	BC-221	Fast Interpolation
	3	BC-453	Base for Ham Receiver
		BC-458	On SSB
	9	T-47/ART-13	CFI Xfmrs in Q-mult/Q-5er Pkg
	11	BC-625	SSB with C. E. 20A Exciter
	12	Cmnd Rcvrs	Product Detector
57	2	BC-458	As Heterodyne VFO for SSB
		Hammerlund SPs	<H&K> Stabilizing & Audio Impr.
	3	PE-101	<H&K> Rewire for Other Outputs
	7	AN/APR-1	T. U. Butterflies as Wavemeters
		R-54/APR-4 &	
		R-444/APR-4Y	
	8	BC-929	As Oscilloscope
	9	BC-348	<H&K> Improv Calib & BFO Trim
		TG-34	<H&K Used to Key Transmitter
	10	Cmnd Trans	<H&K> Adding Marker Crystals
	12	BC-459	As Overtone VFO
58	3	BC-221	<H&K> As Carrier Inject Osc.
	4	BC-453	With Gonset Super-Six
	12	BC-342	Adding a Q-multiplier
59	1	BC-454	On 80 meters
	4	BC-454	<H&K> Bandspreading
	7	BC-348	<H&K> Alignment
	8	BC-453 - 455	As Triple-Conversion Receiver
		BC-458	On 15 meters SSB
	9	BC-453	As Tunable IF
	11	BC-457, -459	Crystal Controlled
		Cmnd Rcvrs	Parts in Phasing SSB Exciter
60	1	BC-454	Coil Data for 160 to 6 meters
	3	BC-454, -455	Regen for Improved Selectivity
	5	T-23/ARC-5	On 2 meters SSB
	6	BC-454, -696	As Complete Station
	9	RT-82/APX-6	On 1215 mHz
	11	BC-455	With 6 & 2 meter Converters
	12	BC-3454	NL, AVC & S-meter
61	1	BC-455	As Mobile Receiver
	2	BC-453	Base for Ham Receiver
		RT-82/APX-6	Conversion Information
	6	RT-82/APX-6	<H&K> Moving to Top of Band
63	2	T-18/ARC-5	On 160 & 80 meters
	7	BC-459	<H&K> Keying Improvements
64	5	T-47/ART-13	Adding FSK
	11	I-177	Updating
	12	BC-221	Extending Useful Range
65	4	LM	Calibrating
	9	LM	Instructions for Use
66	6	BC-455	Operating Unconverted
67	5	Selsyns	Antenna Position Indicator
69	1	BC-454	With Converter for 15 & 10 m

YR	MO	SUBJECT	COMMENTS
70	8	Hammerlund SPs	Updates
77	2	BC-221	Solid State
78	4	Misc	<TT> Buying Surplus Gear
79	10	Selsyns	Antenna Position Indicator

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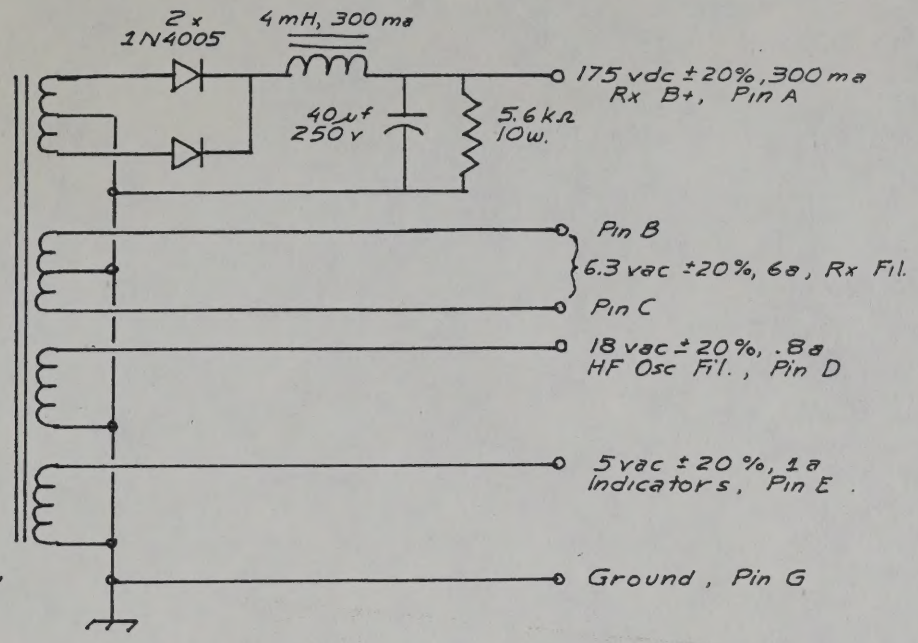
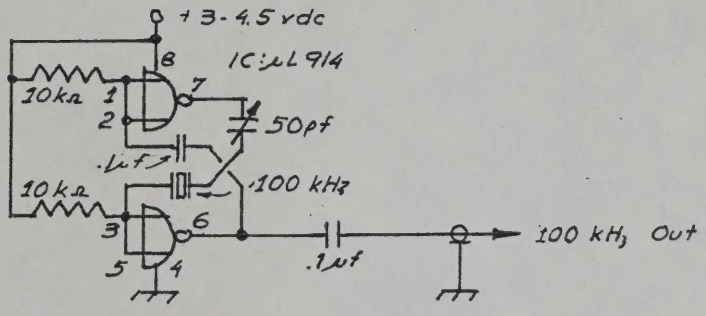
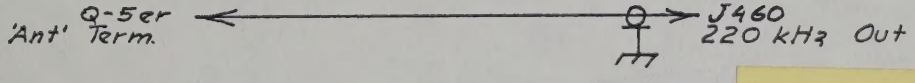
Elect World	61	5	BC-221	Improved Accy & Stability
Ham Radio	68	4	RT-82/APX-6	Conversion Notes
		5	BC-603	Conversion
	69	2	BC-348	Solid State
		8	R-23/ARC-5	Solid State
			T-47/ART-13	Quiet Keying
	70	10	BC-1206	Solid State & 40 m Converter
	74	7	R-390/URR	Product Detector
	75	11	R-390/URR	Modifications
	76	4	R-392/URR	<HN> Semicond. Audio & Diodes
	80	2	R-417/TRC	Filters on 2 meters
		3	R-417	Filters on 1-1/4 & 3/4 meters
		12	F-237/U	Converted to 6, 2 & 1-1/4 meters
	81	3	RT-264/APX	On 1296 mHz
Radio Craftsman	46	10	BC-412	As an Oscilloscope
	47	4	BC-625	Rack Mounted
		9	BC-624	Tunable & Rack Mounted
	48	1	BC-312	Power Supply
			BC-1068, -1168	As Basis for TV Receiver
		6	BC-624	Conv to FM Broadcast Receiver
		8	Misc	List of Conversions
		9	R-44/ARR-5	Power Supply
Radio Elect	48	11	TU-10	As 10 meter Amplifier
		12	BC-455	With 455 kHz IFs
	49	1	Cmnd Trans	As VFOs
		6	BC-191, -375	Components in 80 - 10 m trans.
	50	3	R-89/ARN-5	As FM Broadcast Receiver
		8	BC-221	Adding Modulation
			Cmnd Set Rigs	Command Set Station
		9	BC-610 & GP-7	Tuning Units as VFOs
		10	Misc	List of Conversions
		11	BC-224	Power Supply
	52	6	Cmnd Ant Relay	Calibration Chart
	53	4	Cmnd Ant Relay	Meter as S-meter
	61	3	BC-1206	Use with CONSOLAN System
Radio News	46	5	TS-47/APR	Description
		10	BC-624	Rack Mounted
		11	BC-625	Rack Mounted
		12	T-47/ART-13	Description & Power Supply
	47	9	TU-5	Parts in 3.5 - 4 mHz VFO
		10	TBY	Operating on 6 & 10 meters
		11	BC-191, -375	Tuning Unit Case for Rx-Tx
	48	4	BC-625	On 10 & 6 meters
		6	Cmnd Rcvrs	Conversion & Converters
Radio/TV News	48	9	BC-221	As CW/SSB Carrier Inject Osc
			Misc	Negative Look at Conversion
		12	TU-6	Components in VFO

TITLE	YR	MO	SUBJECT	COMMENTS
	49	1	R-1/ARR-1	Into 1-1/4 meter Converter
	50	4	BC-605	Into Intercom
		8	BC-454, -455	As 20 meter Receiver
	51	4	BC-610	Cleaning Up TVI
		9	BC-453	Tunable IF Above 500 kHz
		12	HS-33	As Phone Patch
			RT-7/APN-1	Sweep Generator from Wobulator
	53	1	Cmnd Trans	As 40 m, 40 w Transmitter
		5	Cmnd Rcvrs	IFs in Mobile Rig







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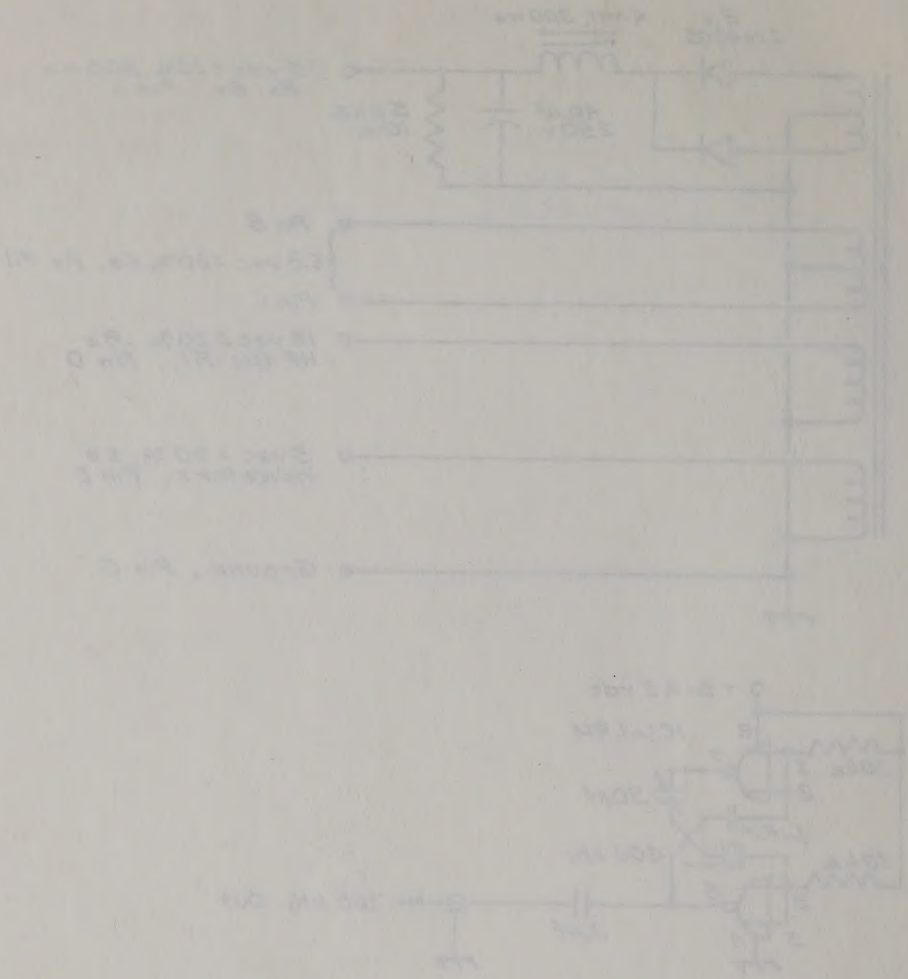
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